CHEETAL

JOURNAL OF

The Wild Life Preservation Society of India

Vol. 17 No. 2

A baby gharial's first look at the world. —*Photo by Dr. H.R. Bustard*

Members and Subscribers are requested to note that all yearly subscriptions fall due on 1st of April each year. They are requested to pay in time so that Cheetal may be sent to them regularly.

Change of address should be intimated at the earliest to prevent Cheetal being lost in transit.

Honorary Secretary.

CONTENTS

		Page
1.	A Future for the Gharial by Dr. H.R. Bustard	3
2.	Wildlife in North Sikkim by B.K. Bardhan Roy, I.F.S., Dy. Conservator of Forests, West Bengal	9
3.	Aquatic Insects in Relation to Fisheries in India by T.G. Vazirani, Zoological Survey of India	14
4.	Wildlife Losses due to Diseases in Indian Wild Animals by S.K. Sinha, Lecturer in Forestry and Wildlife, Indian Forest College Dehra Dun	25
5.	Fish Fauna of Corbett National Park, Uttar Pradesh by Akhlaq Husain, Zoological Survey of India, Dehra Dun	39
6.	Christmas at "Cheetal Walk" by Peter Davidar	43
7.	On an Abnormality in Some Dorsal Vertebrate of Indian Wild Elephant (*Elephas maximus* Linnaeus) by J.C. Tripathi	45
8.	At what age does the male Indian Elephant starts growing Tusks by Dr. B.S. Lamba	46
9.	Crocodile Rehabilitation Scheme in Uttar Pradesh by V.B. Singh, Chief Wildlife Warden	47
10.	Notes	49

CHEETAL

Journal of The Wildlife Preservation Society of India

Vol. XVII } DECEMBER, 1975 { No. 2

Continuing encroachments on forest lands for cultivation and human habitation, large scale nenudation of forests for river valley and hydroelectric projects, commercial hunting and poaching and wildlife exports for earning foreign exchange are some of the factors responsible for extinction and endangering of wildlife heritag of India. But in addition to the above causes a near complete ignorance and lack of interest in birds and animals amongst the youth of the country and particularly among the decision makers and administrators is mainly responsible for the prevailing confusion in the policies and actions of those responsible for protecting wildlife from certain doom. Though a Wildlife (Protection) Act was passed in 1972 by the Parliament some States have not accepted it and even those States that accepted it have failed to implement it faithfully.

Lack of proper priority, a plea of shortage of funds and Commercial vested interests all conspire to defeat the objective.

National Parks and Sanctuaries are created one after another but the basic essentials of wildlife management are ignored except in some cases.

Projects for protecting the Tiger, the Rhino the Indian Lion and other rare species of birds and animals are good intentioned but those concerned are busy at present in building an infra structure first. What is vital is a thorough enforcement of the Wildlife (Protection) Act through a Wildlife Protection Force not only for National Parks and Sanctuaries but for all Forest areas and even for cultivated and barren land.

Ecology Workshop:

An Ecology workshop, sponsored by National Audubon Society (U.S.) in conjunction with National Wild Life Federation of U.S. and with the active co-operation of the Department of Tourism – Government of India was held at Ghana Bird Sanctuary, Bharatpur from 9th to 12th February. The foreign visitors and participants saw the spectacular water bird sanctuary of India. Men who matter in wildlife conservation in India e.g. Dr. Salim Ali, Mr. M. Krishnan and others also participated.

Shri Raj Bahadur, Minister for Tourism and Civil Aviation utilised the occasion to inaugurate the opening of a new Forest Lodge at Bharatpur. The interests of Wildlife Conservation would be promoted if such workshops are arranged in other National Parks and Sanctuaries in India. The Department of Tourism deserves praise for the venture.

Wireless to Protect Wildlife:

A wireless communication system to protect Wildlife in National Parks in India was commissioned at Kaziranga (Assam). The project costing Rs. 1.5 lakhs has 15 wireless sets to cover 450 sq. kms and provide communication with 30 patrolling posts. The sophisticated wireless network would protect the rhinos in Kaziranga in particular and help anti-poaching operations. The World Wildlife Fund has financed its establishment. The Department of Tourism is constructing a Forest Lodge at Kaziranga.

Another such system for Ranthambore Tiger Reserve was presented by Shri Fateh Singh Rao Gaekwad of Baroda—President of W.W.F. National Appeal (India) at the last meeting of Indian Board for Wildlife, New Delhi. Dr. Karan Singh Chairman IBWL and Minister for Health, Government of India accepted it for Project Tiger—a project to save the fast vanishing Indian Tiger from extinction.

———

A Future for the Gharial

(The first part of a two-part article on gharial conservation)

DR. H.R. BUSTARD*

By 1970 it had become clear to Indian and Foreign Experts that the gharial (*Gavialis gangeticus*) an Indian species, which also occurs or occurred in Pakistan, Bangladesh and Nepal, was facing imminent extinction. The gharial, the most unusual of the living crocodilians inhabits rivers rising in the Himalayan Region and is, therefore, north Indian in distribution though it ranges as far south as the Mahanadi (Orissa). This enormous crocodilian—males reach a length of upto about 25 feet—with its greatly elongated snout, an adaptation to fish-eating is the only member of its genus and the sole surviving member of the family Gavialidae. Hence it is of very considerable scientific interest. It was formerly an extremely abundant and obvious member of the north Indian riverine community. The rate of its disappearance has taken most people unawares. It is, incidentally, completely inoffensive to man and domestic animals.

In 1971 the author agreed at the inaugural meeting of the I.U.C.N. Crocodile Specialist Group (of which he was Founder-Secretary) to try to initiate steps to at least increase our knowledge of the present status of the gharial, an essential prerequisite to its protection.

Fortunately Indian minds were thinking along similar lines and about the end of the year the author was approached by F.A.O. and asked to undertake a mission to India. Other commitments precluded an early visit and it was not not until May 1974 that first work could be undertaken. This was an arduous three month field investigation in ten states of all three species of Indian crocodilians. During this time gharial habitat was examined in U.P., Orissa and Rajasthan and subsequently in 1975 in Bihar.

The findings of this survey (F.A.O. 1974) illustrate the reasons surrounding the loss of the gharial. Furthermore, the report made a number of positive recommendations. The account which follows is largely taken from the report.

Crocodile resources have shown catastrophic decline worldwide in the postwar period largely as a result of sophisticated hunting methods combined with the insatiable demand for hides by the luxury leather market. Control of shooting was generally lax, if it existed at all, and in many parts of the world whole populations disappeared before adequate controls could be implemented.

India has been no exception. Crocodile populations have been extremely hard hit.

*Dr. Bustard is F.A.O. Consultant/Crocodile Farming/Govt. of India. His address is Camp & P.O. Tikarpara, Dist. Dhenkanal, Orissa.

Crocodile hunting is now legally banned in India. The Wild Life (Protection) Act, 1972 lists both species of crocodile and the gharial under Schedule I which affords total protection at all times. Similarly Export Instruction No. 46/73 forbids the export of crocodiles and gharial, their hides or products therefrom.

Status

The gharial, formerly an abundant species* faces a critical situation in which its very survival is in jeopardy. Its habitat has been alienated much more radically than that of the two crocodile species. Habitat has disappeared as a result of 'training' rivers between embankments to prevent flooding; 'tidiness' in planning (in which 'unsightly' natural features such as large sandbanks, essential for gharial nesting, are replaced by concrete embankments), and loss of former riverine habitat by dam construction for irrigation or hydro-electric schemes. These, combined with fishery management of the resulting habitat, the lethal effect of set nylon nets now used in fishing, and poaching activity, have all weighed heavily against the survival of the species. Habitat for gharial, free from alternative detrimental usage, no longer exists.

The gharial has shown remarkable adaption to the loss of its nesting sandbanks in the main river courses, flooded as a result of increased water levels resulting from dam construction, and has successfully adapted to nesting in nullas (side creeks.) Its extirpation from the remaining habitat has come about as a result of set netting, now standard fishery procedure.

Remaining populations are extremely small and the *rate* of loss means that extinction is certain within the very near future. For example the population in Satkosia Gorge on the Mahanadi river is down to 4 (two males and two females). The eggs are under constant threat from the Matia, a nomadic tribe employed by the P.W.D. in earthwork construction, who relish crocodile eggs and are skilled in nest detection.

In Rajasthan the species still occurs in the Chambal River but the rate of loss once again means that only urgent acton will prevent it from becoming extinct there. The best comparatively safe habit is the 12 m (19 km) stretch of the Chambal between Rana Pratap Sagar Dam and Jawaharlal sagar Dam (Kota Dam not the barrage). According to a Forest Ranger with a lifetime's experience of the area and a keen interest in gharial, the mature gharial population consists of about 10–15 individuals. The expert was advised that the gharial were not threatened by poaching or fishery activities. However, as a result of a

*For instance James Inglis (1890) in his book 'Adventures in Tiger Land' wrote, 'Going down the river KOSI (north Bihar) particularly you come across hundreds sometimes lying on one bank'. Col. K.K. Singh told the expert that on a boat journey from Kota to Pali down the Chambal River (Rajasthan) a distance of about 100 ml. (160 Km.)—he shot 100 crocodiles of which 50-60 were gharial.

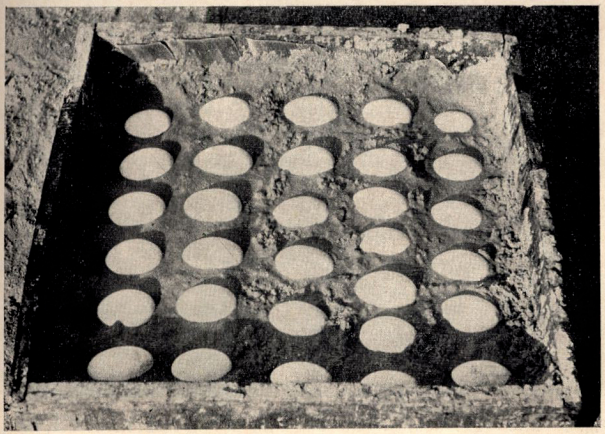


Fig. 1.—Forest nursery box partly emptied of sand to show arrangement of gharial eggs for transport from Bihar to Orissa, 1975

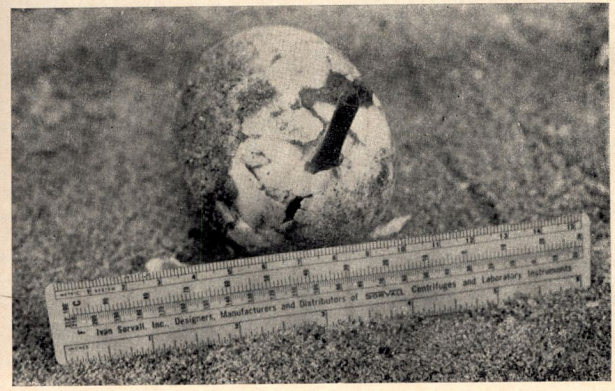


Fig. 2—The bizarre, elongated snout of a hatchling gharial breaks through the egg shell for the first time in captivity

—*Photos by* : Dr. H.R. Bustard

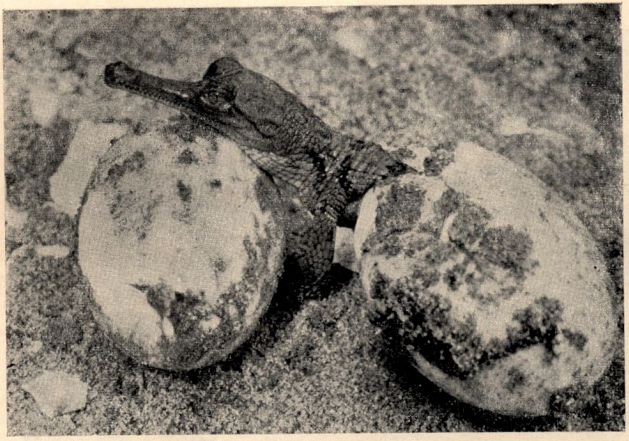


Fig. 4—Two eggs hatching. One hatchling has the front limbs free, the other's snout (see plate 2) is directly facing the camera.

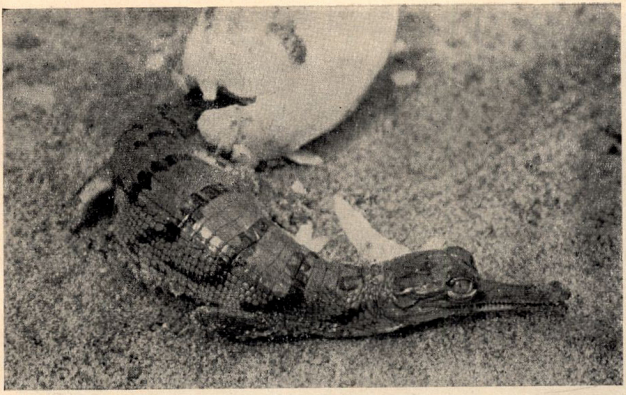


Fig. 5—With a sudden rush (the shutter speed is 1/500 second) a baby gharial emerges completely from the egg shell.

—*Photos by*: Dr. H.R. Bustard.

brief survey it was found that no less than 7 large gharial had been killed during a fishery contract lasting 4–5 days in the previous month. All had been skinned. Since this is half the estimated population the future for the remainder is hopeless unless the area is gazetted as a sanctuary, fishing activity is stopped and active patrolling instigated. It is gratifying that the Government of Rajasthan is already taking steps to create this area a sanctuary. The area is not well suited to fishing being extremely rocky. It is, however, ideally suited to gharial but unless the area is transferred to the Forest Department before the next annual fishing contract is let the species may well be wiped out in the Chambal.

The gharial is probably extinct in West Bengal. It was not possible to survey the last remaining Bihari populations which occur in the N.W. near the border with Uttar Pradesh. In Uttar Pradesh, the species is barely surviving even in the world famous Corbett National Park. Here habitat destruction, resulting from the construction of the Kalagarh Dam, has destroyed virtually all remaining suitable habitat and the remnants of the population (numbering about four individuals) have had to move up-stream to small, poor habitat, water holes never previously occupied by gharial where they are in competition with mugger. Furthermore, dynamiting for fish within the National Park has affected two of the few occupied water holes in the last twelue months. Significantly, the Parks Officer, Negi, and Forest Guard Howard, both good wild life observers, have never seen juveniles though they have both been stationed at Corbett for 13 years and are competent naturalists.

A preliminary survey of the gharial has also been conducted during 1974 by Whitaker *et al.* (published privately). Their views concur with those of the expert, namely that the gharial is on the verge of extinction.

Reasons for decline

Major disappearance resulted from large-scale skin hunting, with the disappearance of all large populations and total legal protection afforded to the remnants this phase is past. The problem now centres around poaching and destruction of the remaining gharial resource by fishery activities either direct or indirect. Incidence of poaching is highly variable from locality to locality. Although severe in some places, in others, including some locations investigated by the Consultant, poaching is either insignificant or totally absent. Crocodile losses from fishery activities, however, are extremely widespread and areas free from this are the exception.

Modern fishing methods have been most damaging and in many areas are the major threat to the survival of the gharial. Until recently villagers fished using traditional methods such as throw (cast) nets, scoops and lines with baited hooks. All of these are completely innocuous to gharial.

The State Fishery Departments have recently been active in promoting the use of nylon gill-nets. These large nets, equipped with floats and sinkers, hang down in the water

across whole stretches of rivers, backwaters and reservoirs. They are lethal to crocodiles which become entangled in the nets and quickly drown as a result of their struggles. The nets are generally set in the evening and taken up the next morning. Should the villagers notice that a gharial is caught in the net they will club it to death to save the net as the latter represents a substantial investment. This is not a deliberate act of poaching, although illegal. In many parts of India the villager may not even bother to skin the carcase, as, the price he receives for the hide may not even recoup his effort. However, extensive destruction of gharials in this manner negates in practice the legal protection afforded them by the 1972 Wildlife (Protection) Act.

The future

In the past little thought was given to crocodile protection. This situation is now changing as a result of the Wildlife (Protection) Act, 1972 which singles out the two species of crocodile and the gharial for total protection under Schedule I. Responsibility for wildlife matters is vested in the Forest Departments in the State. The Forest Departments in all State visited professed a keen interest in wildlife, including crocodile conservation. They showed a desire to implement crocodile management schemes with the assistance from the Union Government and they assured the Consultant that they could contain poaching where this was a problem. However, almost without exception, they expressed concern about the apparently conflicting approach of their own Fisheries Departments.

Undoubtedly the most encouraging facet of the mission was this ever present interest in wildlife conservation problems. Not unexpectedly knowledge concerning crocodiles was extremely scant and expertise in the conservation management field as it applies to crocodiles was absent, but the interest and desire to succeed were there. The Forest Service with its efficient nationwide administrative and field network in all States is uniquely placed to tackle the problem.

To summarise

Crocodiles and the gharial no longer represent a croppable economic resource in India, and, furthermore, their very existence is threatened, imminently in the case of the gharial probably in the short term for the salt water crocodile, and over the next decade or two in the case of the mugger. This together with absence of recent reliable information on their status prior to the present mission, forms the basis of the problem

Conclusions and recommendations

The Consultant located many areas of ideal habitat, populations urgently in need of managed conservation, which can form the basis of a sustainable foreign exchange earning industry, and has noted a keen interest in the Forest Service to embark on Wildlife management.

Crocodile farming is solely viable in tropical areas. The environment of much of India is ideal. Accordingly the Consultant recommended that a *pilot crocodile farming project* be set up to train Indian personnel in all aspects of crocodile management, and to multiply crocodiles of all three Indian species, initially for conservation purposes, and subsequently for economic enterprises.

That the *location* of the pilot farming project be Orissa and West Bengal in view of extremely favourable husbandry conditions in these localities and the presence of all three Indian species.

That simultaneously the best *conservation advice* be made *available to the States* in the field so that immediate remedial action can be taken to conserve the remaining crocodile resources. Otherwise there will be no resource available for subsequent management when personnel have been trained at the Orissa–West Bengal farming projects. The form recommended for the pilot project is as follows:

(a) *Orissa.* A central co-ordinated battery type farm utilising all three species and three outstations, one for field management of each species, gharial at Satkosia Gorge (Tikarpara).

(b) *West Bengal.* A battery-intensive farm for both saltwater and freshwater crocodiles in the Salt Lakes close to metropolitan Calcutta and a free-range management scheme in Sunderbans for the saltwater crocodile.

That in free-range management schemes and their derivatives the villagers be fully incorporated into the project. Failure to do this, and thereby return a sizeable proportion of revenue earned from the crocodile resource in any area for the development of that area will jeopardise the scheme. This approach, basic to wildlife management, is frequently overlooked. Poaching is not possible without the knowledge and active participation of the local people.

The best hope for the threatened gharial lies in active management. This will require substantial investment in personnel, habitat areas and funds. This would only appear to be possible if it is clearly stated that the gharial conservation's ultimate aim is economic management to benefit the local communities.

The managing agency should establish close liason with Fisheries in order to (a) prevent loss of the remaining crocodile resource in areas managed by Fisheries and (b) try to establish multiple water use schemes (concurrent crocodile and fish management) in suitable areas.

A thorough, academically based study is needed in India on the ecological role of crocodile-fish relationships. This would flow naturally from the pilot project if initiated. The findings from such studies should be disseminated as widely as possible.

The success or failure of the schemes will depend on the personnel selected. Key personnel should be young and be offered a permanent career in crocodile management.

They should implement management procedures, although, of course, conservation work will continue to be dependent on the Forest Department administrative machinery.

It was recommended that all training of personnel take place in India, working on Indian species under Indian conditions. Training outside the country was considered to have relatively little value in view of its doubtful relevance to Indian conditions.

Personnel will require to be trained at all levels. To maximise the success of the operation India should produce its own experts in crocodile population ecology. As a result of decisions, based on extensive ongoing research, a truly Indian approach to crocodile farming can be developed which will not be dependent on outside inputs. At present no such people exist in India and very few anywhere. Induction of personnel with sound academically based qualifications is budgeted for from the initiation of the Orissa Pilot farming scheme in the State Plan.

Zoos

(a) *Farming.* Crocodile farming operations are not generally suited for Zoological Gardens. They are specialist activities to be carried out by trained personnel working preferably in conjunction with Sanctuaries or other areas of natural habitat, or as separate, entities (battery farms).

(b) *Gharial breeding.* Zoos holding groups of gharial should be encouraged to make every effort to breed this endangered crocodilian. Zoos should not collect further wild stock except in exceptional circumstances.

The overall aims of the proposed project are twofold:

(a) to ensure the conservation of India's three species of crocodilians as a result of extensive management in natural habitat areas.

(b) as a result of (a) to build up an export industry with maximum foreign exchange earnings. The latter will best be achieved by following the policy being implemented in the Indian leather industry with major success-processing the hides as far as possible within the country prior to export.

The proposed project has been initiated in Orissa and a similar project will commence shortly in U.P. An account of this work will be given in the concluding part of the article.

References

F.A.O. (1974) India; A preliminary Survey of the Prospects for Crocodile Farming. (Based on the work of H.R. Buatard, Consultant). Fo: IND /71/033 October 1974. FAO. Rome.

Whitaker, R. *et al.* (1974) Preliminary survey of the Gharial (*Gavialis gangeticus*). Madras Snake Park Trust and Conservation Centre.

———

Wildlife in North Sikkim

By

B.K. Bardhan Roy, I.F.S.

Dy. Conservator of Forests, West Bengal

[*The author was the Conservator of Forests (Working Plans) in Sikkim from April, 1973 to May, 1975. During this period he had travelled through remote areas of Sikkim and collected necessary information for writing up this article.*]

Summary

North Sikkim with tangled series of interlacing ridges clothed with magnificent flora and alpine meadows is a fascinating abode of wildlife. Some of the species are on the verge of extinction. Difficult terrain makes it impossible to make a scientific approach in assessing the number of important species. Lack of resources and technically qualified personnel makes it difficult to study their distribution, behaviour, breeding-biology etc. A concerted attempt is needed if these species are to be saved from extinction.

Introduction

Sikkim, with 2828 Sq. miles in area, roughly 70-80 miles long (North-South) and 30-40 miles broad (East to West) is an oblong wedge between Nepal, Tibet and Bhutan.

On the northern boundary of Darjeeling, the great Himalayan ranges throw out to the southward two enormous spurs—the Singallila and Chola ranges, with two further prominent ridges in the middle, viz., Karsang-Tendong and Kinchenjhow-Chungthang. These fascinating mountainous tracts consists of tangled series of interlacing ridges, rising range above range to the foot of the wall of high peaks and passes which mark the abode of snow and its off-shoots.

The lowest elevation of the state is 700 ft., the highest, 28160 ft.—being the top of the Kanchenjunga itself.

The rugged valleys, deep gorges and alpine meadows of the north, (beween 27°30′ to 28°10′ north latitude) harbour Sikkim's rich heritage of wildlife. Little has been done so far to preserve wildlife in Sikkim, although some rare and distinct varieties inhabit the interior areas of the north, mostly at high altitudes. At the instance of the Chogyal of Sikkim, Forest Department organised a team of Foresters and Rangers to locate and assess the number of different species in the northern part of the country. No systematic survey has been done to assess the number, but from the report of their observations, certain information could be available.

Of the Himalayan goat antelopes, thar, goral and serrow appear to be common. Thar (*Hemitragus jemlahicus*) inhabits the steep and dangerous precipices formed of massive wall-like granite-gneiss. The deep gorges in Lachen-Lachung, Dombang areas seem to be their favourite haunts. They range between 8500′ to 14000′ having coniferous forests and open areas where they graze and browse on slopes having grasses and bushes and then clsmb up on to the same precipice to spend the night. Serrow (*Nemorhaedus* spp.) also moves in the altidudinal zone between 10,000′ to 12,000′, in Lachen and Lachung valleys. Lachen and Lachung-pas (villagers of Lachen and Lachung) seem to be distinguishing two types of Serrows, one having white or grey feet, the other having rufous legs and thick fur covering the body, former being the *N. bubalinus* and the latter presumably, *N. sumatrensis*. They are most retiring, living on bush-hung cliffs and being rarely seen. Similar in appearance to the Serrow, with shaggy hair and short horns is the goral (*Naemorhadus goral*), locally known as 'Ragyiat'. They move in the same altitudinal limit as the other two goat antelopes, feeding on grass during summer and on leaves and branches in autumn and winter, inhabiting great cliffs of the river gorges. Another goat antelope was discovered by Mr. Shefer, during his expedition in Sikkim in 1938-39. This is presumed to be a subspecies of Thar, which is locally called *Shapi*, which Shefer has named as Hemitragus jamlahicus Sheferi. This species or the subspecies was considered to be extinct in Sikkim Himalayas, but recently, about 6 (six) numbers have been located near Pemikhanchan, commonly known as Phimphu, opposite Rangma. It has thick fur covering the body, with long beard, like the Ibex of the Western Himalayas. Horns are about 12″ long rising straight. Vegetation in this altitude consists mainly of *Pyrus foiistosa*, *P. microphylla*, luxuriance of herbs, such as *Senecio*, *Saxifraga*, *Prunela*, *Potentilla*, *Polygonum*, growing intermingled with grasses. Even during winter, they remain in the snow, scraping a living from scrub and grass uncovered by their feet.

Amongst the Tibetan sheep, *Ovis ammon hodgsoni* (local name *Nen*) and the blue-sheep or Bharal (*Pseudois nayaur*) abound in North Sikkim. *Ovis ammon* is a trans-border grazing creature, spending most of the time in Sikkim and also breeds in Sikkim. They are generally found to be concentrated below the mountain passes of Chholamo, Se-se-la, Dorjeela, Dongkang areas, having altitudinal ranges between 16000′ to 18000′. Although official figure puts them to be around 200 in numbers, local estimate is only 50-60. This species does not range below 15000′ altitude. But in winter, it may descend to about 12000′ in places. The animal is extremely watchful and speeds away at the slightest sense of danger. This animal is said to possess acute sense of smell as well. Open, undulating alpine meadows, characteristic of the Tibetan plateau, above 16000′—17000′ altitude provide extensive areas for grazing. Vegetation is scanty and consists mainly of *Ranunculus*,

grasses and sedges, *Cyananthus*, blue asters, gentians, *Prunella*, *Senecio*, *Saussurea*, *Saxifraga*, *Polygonum companulatum* etc. It is said that the massive and the peculiar size of the horns are sometimes cause of death of the animal due to starvation, as the horns prevent the mouth of the animal from reaching the ground !

Bharal or Blue sheep (*Pseudois nayaur*), locally known as *Nagwa*—a smaller variety of mountain sheep, are numbered 360 (officially), mainly spreading over pasture land near Khoradothang, Chorten-Nyimala and the Green Lake areas. It is found in herds of 10-50 in numbers. It is seldom seen below 10000′ and is generally found from 14000′ upwards in summers.

Takin (*Budorcas taxicolor*) was perhaps one of the original inhabitants of this region. It has not yet been spotted anywhere, but its existence has been proved from its excreta left at places like Talampho and Yume Samdong. They are reputed to be dangerous when alarmed, ready to attack man or beast, even when unwounded.

Another interesting animal of the high altitude is the Chiru (*Pantholops hodgsoni*), locally called *Choy*. This species is rarely seen these days in Tibet-Sikkim border. The horns of the species are considered to be very auspicious amongst the local people. There is a belief that if the horn is planted near the site of construction of a house, nothing adverse can take place.

An important animal of North Sikkim is the Musk-Deer (*Moschus moschiferus*) usually moving in areas between Zakthang and Zemu, covering Tholung. It ranges between 11000′ to 14000′ altitude, and rarely comes to 10000′. The name of the species suggests the reason for their decimation over the years. Every year a number of them are trapped and killed by laying snares over very large distances by the musk-hunters. Nothing tangible could be done so far to protect these animals from poaching, except sending patrol parties during August/September and October to destroy the traps laid in the zone.

The pasture of the Tibetan wild ass, the *Kiang*, (*Equus hemionus Kiang*) is in the severe climatic zone between 16000′ to 18000′, in Cholamo and Donkiala region. The ground is dotted intermittently with vegetation like *Sedum*, *Rheum nobile*, *Ranunculus*, *Cyananthus*, *Erigeron*, *Crepis glomerata*, *Saussurea*, *Saxifraga*, *Astragalus*, *Myosotis* etc., besides grasses. Large herds were common in this zone moving on both sides of the border between Tibet and Sikkim. But the presence of defence personnel on both sides of the border, has restricted the movement of these animals and a few, 10-20 are sometimes seen on this side of the border. There has been a further decimation of this animal in 1968, when heavy

accumulation of snow completely burried the vegetation depriving the animals of their food. In 1972, 9 (nine) numbers of skeletons of Kiang were found between Chholamo and Se-Se-la; the real reason of their death is still obscure.

Amongst the predators, tiger is an occasional visitor in high altitude. In July/ August, 1974, one tiger was reported to have killed about 15 cattle, including yaks. It killed a number of cattle near Mangan and moved to Naga areas and then to Dombang (10000') where it killed six Yaks. Then it moved to Lobongten, Kewsay between the altitude of 9000' to 10000' and finally left Sikkim. From its kills in different areas, a rough track of the animal could be drawn up. Thus, it might have come through Rachila, to Regu, to Phadamchen, crossed to Lamaten and moved to Barapathang. From here, it came to Kabi-Phensong, to Mangan, then to Naga, and moved towards Lachung. It went further up to Dombang and might have returned following the same track via Lobongten and Kewsay.

The villagers believe that the tiger comes to collect its 'taxes', and leaves the place, only to appear again after 2/3 years.

Among the handsome feline predators of the mountain ranges are the clouded-leopard, the golden cat and marbled cat the latter usually range in lower altitudes. Snow-leopards hunting on herbivores are said to be ranging upto 18000' in summer.

Amongst the Canidae, the wolf plays an important predatory role as does the wild dog.

The Himalayan Black bear (*Ursus torquatus*) is a forest animal and is found at various elevations, from near the base of the hills to about 12000', while in winter, it descends to 5000'. It is found frequently around villages, feeding on field of grains. Another bear, locally called as "Rukh-Bhalu" frequents lower valleys. This is said to be considerably smaller in appearance, and an admirable climber. It is probably *Ursus malayanus*, which has been recorded from Malay to Chittagong and the Garo hills and may, perhaps, be ranging as far west as Sikkim.

Panda, common panda or lesser Panda, as the animal is variously known is found in Rhododendron and bamboo forests, between 7000' to 12000' altitude.

Himalayan Langur (*Semnopithecus schistaceus*) is seen in the zone between 7000' to 12000' altitude, particularly near Lachen and Lachung. According to the local villagers, there are two species at those high altitudes—one of large size and going in pairs only and

the other smaller in size moving in a company of 20 to 40, often visiting the hot springs to lick the saline matters. From the descriptions given by the local peasants, one tends to identify them as Snub-nosed monkeys or *Rhinopithecus roxellanae*, reported to be available in Southern Tibet and Assam. However, till the presence of this species in this zone is confirmed by a naturalist, such statements of the local peasants need be treated with caution.

Amongst birds, there are more than 550 species and sub-species. It is impossible to give a detailed account of all the birds available in Sikkim in this short note. However, mention is made about the ones seen in North Sikkim, but not very common in other areas. Thus crimson Horned Pheasant or Satyr Tragopan, Blood pheasant and Moonal have been spotted near Dombang, Potala, Zakthang, Zema, Lachen and Lachung valleys. Snow patridges are found in numbers at altitudes such as Khaaring, Se-Se-la, Khongra-la, Khoradothang, Lhonak where Golden Eagles are also found. Large high altitude ravens are commonly seen at Yakthang (11000') and above and in Dombang (10040') altitude and said to number about 50, whereas, the smaller variety of yellow-beaked ravens are also found in the higher altitudinal lakes, usually between March and September.

Recommondations :

Gifted with superabundance of Rhododendrons, Primulas and other luxuriant flora and fauna, North Sikkim offers a tremendous potentiality for preservation and multiplication of some of the finest and the rarest species of wild animals and birds. If these species are to be saved from extinction, a concerted drive has to be made. A special body needs be set up for the protection of these animals and various other rare species which occur roughly north of a line running through Yume-Samdong and Thangu. Intensive ecological surveys of birds and animals and their life-cycles, breeding biology, population dynamics etc., so urgently necessary, can only be done by expert observation and supervision. Creation of musk-deer farm somewhere between Yumthang and Dombang which will be comparatively easily accessible for the supervision, would not only protect this species from complete extinction, but also open up avenues for commercial exploitation of musk and in promoting tourism. Once the behaviour pattern of the wildlife of the North is studied, Government may embark on major schemes for their propagation, which is bound to yield rich dividends both scenic and material.

———

Aquatic Insects in Relation to Fisheries in India

By

T.G. Vazirani

Zoological Survey of India

Introduction

The aquatic insects play a very important role in the production of fishes as they form a complex food chain in the community of lake, pond or a stream. They are very conspicuous in these habitats and also occur in very unlikely places as a hole in a tree or an empty tin or a hollow earthen vessel in which rain water has accumulated. In Fisheries they play a triple role (i) they serve as source of food for the carnivorous and omnivorous fishes (ii) the carnivorous species of insects are predatory on the fish fry (upto 5 cms.) in nursery ponds (iii) they compete with fishes for the available food supply viz. phytoplankton and microzooplankton. In India some investigations have been made on the first two aspects but very little is known about the third aspect which can however be easily surmised.

Out of the twenty nine orders of insects, now recognised for living insects, as many as ten orders have truly aquatic representatives. All of them except the bugs and beetles live on land or in air as adults but spend only the larval or immature part of their life in water. The bugs and the beetles too are mostly dependent on the atmospheric air. Thus in spite of their large numbers, they are incompletely adopted to aquatic life. Perhaps this explains the observed fact that the insects generally inhabit only shallow ponds and streams and they are comparatively scarce in very large rivers and lakes. It therefore follows that their role is limited to the fisheries resources of ponds, streams and shallow areas of lakes which resemble ponds in ecological conditions.

Pond culture has been practised in India, perhaps since the dawn of history. The fish species commonly utilised in pond cultural practices are known as 'Major Carps'. In recent years attempts have been made to introduce certain carnivore species of fishes in provinces like Uttar Pradesh, where people like their taste. Game fishes like Trout have also been introduced in the streams/shallow parts of lakes of Kashmir and Himachal Pradesh, where they are thriving well. Recent literature on aquatic insects that help by way of food of fishes or hinder by way of being predators on the fish species that are reared in the nursery ponds has been reviewed here. The literature regarding food of the Indian hill-stream fishes is almost nil. The papers dealing with the quantitative analysis of the food of fishes are also very few. The identification of the insect species that form the food of fishes hardly goes beyond the level of 'larvae of..... order/family'. In case of predatory insects the position is a little better as quite often the generic names are also

mentioned; but sometimes these are not accurate. Certain genera which do not occur in India are also mentioned occasionaly. There may be certain difficulties in identifying the insects taken from the gut contents of the fishes, in view of the partial digestion that might have taken place before the dissection of the fish for examination. It is therefore necessary that a thorough investigation is made of the pond/lake/stream for the insect fauna, where ever such studies are undertaken, in view of the complex nature of the problem.

Insects as Food of Fishes

Many Icthyologists have studied the food of fishes and their feeding habits. But this is generally limited to the fishes of economic importance. On the basis of the feeding habits, fishes are divided into the following groups—Carnivorous, Omnivorous and Herbivorous. They are further divided, on the basis of their habitat viz· surface feeders, middle feeders and bottom feeders. In terms of economic importance, major carps occupy the first position, some of them are omnivorous in their early stages otherwise they are generally herbivorous. Cat-fishes occupy the next position and many of them are carnivorous or even predators. Recently introduced game-fish, trout, is also carnivorous.

Khan (1934) observed that fish fry of *Labeo rohita* up to the age of nine months was a heavy feeder of mosquito larvae and crustaceans. He was probably the first worker, in India, in this field.

Moitra (1956) published an abstract on the quantitative studies on the food of some carnivorous fishes of Uttar Pradesh. This work was enlarged by Das and Moitra (1964) and they published the results of their studies on the food of 24 fishes and classified the following fishes as carnivorous with an average annual animal feed of 80-99%. Insects dominated in the food of most of these fishes.

Callichrous pabda
Mystus cavasius
Ambassis ranga
Notopterus chitala
Rita rita
Mystus vittatus
Ambassis nama
Ophicephalus striatus
Glosogobius giuris

According to the same author, the under mentioned fishes are omnivorous with an average annual animal feed between 14.6-78.1%.

Catla catla
Puntius sarana
Colisa fasciatus
Eutropiiohthys vacha
Puntius sophore
Rohtee coiio
Oxygaster bacaila

Subla and Das (1970) deal with the feeding habits of nine fishes from Kashmir. The adult insects obtained by them in the gut contents were *Gerris* spp., *Gyrrnus* spp., *Notonecta* spp., *Nepa* sp., *Ranatra* sp., The insects larvae that from part of the animal food of the fish chiefly consist of larvae of Caddisflies, Dragonflies, *Chironomus* spp., mosquitoes and Sandflies.

Job (1941) studied the feeding habits of glass fishes of the genus *Ambassis* and found that they fed themselves largely on the mosquito larvae.

Mukherjee *et al.* (1946) studied the food of the common fishes of Bengal and came to the conclusion that insects and their larvae were present in the diet of *Notopterous notopterous* and *Nandus nandus*, to the extent of 10-33%. The insects were not identified.

Chako and Kuriyan (1948) have recorded insects and their larvae in the diet of nine species of *Barbus* in Madras; but they were not present in significant quantity.

The success of the Trout *Salmo trutta farrio* Linnaeus, a game fish introduced into Kashmir and Himachal Pradesh, is perhaps largely due to the availability of larvae of Mayflies, as food, in the streams and shallow portions of the lakes in these areas. This is besides the general climate and other considerations.

Saigal (1970) has made qualitative and quantitative studies on the food and feeding habits of the catfishes *Mystus aor* (Hamilton) and has shown that in the adult fishes the insects formed 27.73% of the total gut contents in 38% of the fishes examined. In the case of the juvenile fishes he came to the conclusion that '..... insects predominated as a single item of food accounting for 47.98% of the total food volume and being accounted in 62.9% of the fishes examined'. According to the same author, the insects encountered in the gut contents were Coleopterous larvae (*Emils* sp., *Cybister* sp. and *Dytiscus* sp.), Dipterous larvae (*Culex* sp., *Chironomous* sp., *Dixia* sp. *Eristalis* sp., and *Simulium* sp.); Odonata nymphs (*Aeschina* sp., *Cordula* sp., *Neurocordula* sp., *Sympetrum*, *Epiaeschina* sp,, *Nasiaaeschina*, *Neoaeschina* sp., and *Mesothemus* sp.; Ephemeroptera nymphs (*Ephemera*, *Hexagenia* sp. and *Cempsurus* sp.); Hemiptera (water bugs) belonging to *Corixa* sp., *Ranatra* sp. and *Notonecta* sp; *Plecoptera* : *Perla* sp.

Alikunhi (1957) has listed the following important freshwater food fishes which consume insects as their natural food.

1. *Labeo konitus* (fingerlings and adults) 2.* *Barbus carnaticus* (fingerlings and adults) 3.* *Barbus* dubius (fingerlings and adults) 4. *Barbus hexagonolepius* (fingerlings) 5. *Cyprinius carpio* 6. *Etroplus suratensis* 7.* *Osphronemus gorami* (fingerlings and adults) 8.* *Anabas testudineus* (fingerlings and adults) 9.* *Clarius magur* (fingerlings and adults) 10.* *Hetropneustes fossilis* (fingerlings and adults) 11.* *Megalops cyprinoides* (fingerlings and adults) 12.* *Ophicephalus striatus* (fingerlings and adults).

Motwani and Karamchandani (1958) have studied the food and feeding habits of *Clupisoma garua* (Hamilton) and *Eutropiichthys vacha* (Hamilton) which form a sizeable fishery of considerable importance at Allahabad. The former feeds on insects which includes both terrestrial and aquatic insects; the terrestrial insects are those which fall accidentally into water. The aquatic insects that were found in the food contents were** Plecoptera (nymph); adults and larvae of Coleoptera, Diptera, Odonata, Ephemeroptera, Hemiptera (*Notonecta*, *Corixa*, *Ranatra*) and Trichoptera.

Nataranjan and Jhingran (1961) have devised a method of grading the food elements in the stomach contents of fishes.

Bhowmick (1969) has shown that adults and juveniles of *Glossogobius giuris* (Hamilton) which forms a fishery of some magnitude in the gangetic delta feed upon aquatic insects to the extent of 5.9 and 8.1% respectively of the total food consumed

Vaas and Vass-Van (1959) have studied the production and utilization of natural food in the carp ponds. They observed corixid bugs in the gut contents of the major carps It may therefore be presumed that major carps in India may also be utilizing these bugs, whenever and wherever they constitute substantial population in a pond.

In the foregoing survey of literature many orders of insects have been mentioned. Various important orders of aquatic insects with their common genera/species that occur in India and constitute food of fishes are mentioned below:

EPHENTROPTERA—The nymps of may flies constitute a very important food for fishes. Some common Indian species are: *Cloen dibterum* Linn., *C. pulchellum* Banks, *Ephemera immaculata* Eaton, *E. vedana* Banks, *Anagenesia minoe* Eaton and *Palingenia orientalis* Chopra.

ODONATA—They are found abundantly throughout the plains. Only the nymphs live in water. While some of them constitute the food of certain species the larvae of these are predatory in nature. Some of the most common genera are: *Anax*, *Ceriagron*, *Rhyothenis*, *Ischneura*, *Pseudagrion*, *Ictinus*, *Bradinopyga*, *Crocothemis*, *Pantala*.

PLECOPTERA—They are not of much economic importance. They generally occur in cold torrential streams. Some hill stream fishes feed on their larvae. The common genera in India are *Nemoura*, *Perla*, *Neoperla*.

HEMIPTERA—Corixidae—(Water boatmen) Some species form food of fishes. *Sigara hieroglyphica* Dufour is cosmopolitan in occurrence and is widely distributed in India also. *Micronecta striata* Fieber is another common species in India.

---

* Insects are preferred and form more important part of diet than other zoo plantation.

** Considered terrestrial by authors. It is doubtful if they occur in Allahabad.

Gerridae (Pond-skaters). They live on the surface of water, in shaded areas and where the water flow is moderate. *Gerris* and *Halobates* are common genera which are cosmopolitan in distribution.

DIPTERA—Culicidae (Mosquitoes). The larvae generally inhabit stagnant ponds. *Anopheles* and *Culex* and common genera.

Chironomidae (Midges). The larvae inhabit ponds, slow streams etc. but generally live in the mud at the bottom. The most common genus is *Chironomus*. *Chironomus vicarius* Walker, *C. socius* Walker and *C. cubicularum* Dol. are some common species that occur in India.

Dixidae. These flies resemble mosquitoes and inhabit almost the same areas.

Simuliidae. They generally occur in running water of streams where the bottom has rocky substratum. The larvae are modified to stick to the rocky bottom by means of anal suckers. Therefore they could form food of hill stream fishes which feed at the bottom.

Syrphidae (Hoverflies). The larvae of genus *Eristalis* are aquatic and live in shallow water, not more than 2"–4" deep. In fact the fishes that feed on these larvae are doing good service to mankind because they cause mylasis of the human intestine. *Eristalis arbustomus* Linn. *E. balteatus* are the common species that occur in India.

TRICHOPTERA—(Caddisflies). In India the caddisflies are found in the hills having temperate climate. The larvae are aquatic and live in sheltered places. They construct houses of various shapes. Some of the larvae burrow into stems of aquatic plants and thus keep themselves floating. Some of the common genera occurring in India are: *Dinarthrum*, *Hydropayche*, *Notanatolica*, *Rhyacophila* and *Malanotrichia*.

Insects Predatory on Fishes

As shown above the presence of insects in ponds, lakers, streams and rivers is very desirable, and should be maintained at high population level, specially in stocking tanks having carnivorous or omnivorous fishes. However, there does arise a special situation, in case of fish nurseries, where the presence of predatory insect species becomes undesirable and it becomes necessary to protect the fish fry, which are at the mercy of these predatory insects.

Chaplain (1923) drew attention to the insects that were known to kill fish in America. He mentioned the larvae and adults of *ystiscus* sp. (Col. Dytiscidae); the

giant water bugs, the water scorpions (*Ranatra*, *Nepa*) and the back swimmers. Wilson (1923) also drew attention to the predatory habits and capacity of Dytiscid beetles to destroy fish fry.

However in India, Khan and Husain (1947) have shown that predatory larvae of aquatic beetles take a heavy toll of fish fry as soon as the latter are released in the pond. They also made an interesting observa tion that the tanks which are not stocked with eggs of fish or fish fry, did not show any such larvae and if present they were in negligible number. In their laboratory experiments one larva killed 11 fish fry per hour.

Pakrasi (1954) has observed that *Anisops barbata* Brooks and *A. kempi* Brooks occur in thousands in carp nurseries in Orissa and Bengal during the monsoon season and do immense harm to the young carps which are then transported in these ponds for culture. They are difficult to segregate from the fish fry in sieving operations or other similar methods, being of almost same size as the fish fry at that stage.

Alikunhi (1957) has concluded that *Cybister* spp. and its larvae are highly predatory and are able to destroy fingerlings upto 2 in. (5 cm) in length. He states that Notonectids, *Nepa*, *Ranatra*, Dragonfly nymps and aquatic beetles are all extremely destructive to the tender fry which are transplanted in nursery ponds.

Ganguly and Mitra (1961) conducted experiments to record the extent of damage caused by the larvae and adults of some aquatic beetles and bugs e.g. larvae of *Dytiscus* and *Cybister* (Coleoptera : Dytiscidae) and adults of *Nepa* and *Ranatra* (Hemiptera : Nepidae). They also made observations in ponds in and around Calcutta to substantiate the laboratory experiments. They came to the conclusion that these insects do considerable damage to the fish fry.

Bhimachar and Tripathi (1966) have stated that *Anisops* spp. can kill fish fry upto 1.27 cm. while *Laccotrophes* spp. and *Ranatra* spp. can kill even larger fry.

Few biological studies have been made on these insects. Julka (1965) has given the biology of *Anisops bouvieri* Kirkaldy which is considered as injurious to the fishes in nursery ponds. Vazirani (1964) has dealt with the morphology and ecology of the larvae of *Cybisier* sp.

Coming to the question of colonization of the nursery ponds by the aquatic insects, we have the observations of Pakrasi (1954) and Karamchandani (1957) who are of the opinion that their younger stages are able to pass through screens/sieves which are used for separating carp fry and they get mixed with them. Karamchandani (1957) has listed

several insects viz. Corixidae, *Notonecta*, *Nepa*, *Ranatra*, Gyrinidae, *Dytiscus* larvae and adults, caddis worm houses, Dragon fly nymphs, May fly nymphs and Dipterons larvae (mostly *Chironomus*). Vazirani (in press) has discussed the question of colonization of new ponds by Dytiscidae in the Oriental Region.

In the foregoing account of records, insects belonging to Coleoptera : Dytiscidae (adult and larvae) Hemiptera : Notonectidae, Nepidae, Belostomatidae are reported as predators. To these may be added the larvae of Odonata. Of these the larvae and adults of Dytiscidae are considered most destructive, next come the Notonectidae, followed by Nepidae, Belostomatidae and nymphs of Odonata.

The family Dytiscidae is represented in India by about 200 species, which have been recently monographed by Vazirani (1968-1970). The most common and well known species is the *Cybister tripunctatus asiaticus* Sharp. Eighteen species are now referrable to the genus *Cybister* in India. Genus *Dytiscus* does not occur in India; and its records as quoted above are cases of misidentification. Besides the larvae and adults of *Cybister*, the larvae and adults of the following genera (no. of species known in India in given in parenthesis) are also quite common in ponds and capable of doing recognizable harm to the fish fry. These are *Eretes* (1 sp.), *Hydaticus* (10 spp.), *Rhantaticns* (1 sp.), *Laccophilus* (13 spp.), *Canthydrus* 5 spp. and *Hyphoporus* (16 spp.).

The larvae of these beetles have sharply pointed curved mandibles. The prey is stupified as soon as the mandibles are thrust into its body and body juices are sucked through the mandibular canals. The adults are also carnivorous.

In Hemiptera the Notonctidae, are commonly known as backswimmers and can be easily recognized. About 36 species occur in the genus *Anisops*. The two other common genera viz. *Notonecta* and *Enithares* comprise about 20 and 7 species respectively, in India.

To the family Belostomatidae belong the Giant waterbugs, genus *Lethocerus* and only 1 species occurs in India. The genus *Belostoma* does not occur in India. These insects have a very sharp pointed proboscis/beak which it pierces into the soft parts of the prey and leisurely sucks its juices. The secretion which they pour into the wounds, paralyses the prey. If handled carelessly it may injure the hand in the same manner, in self-defence.

The species of the other genus *Sphaerodema* (3 spp.) are also quite common, though not as harmful as *Lethocerus* they operate in the same manner. But they have a very peculiar habits of laying eggs—the female lays eggs on the back of the male, which carries them till they are hatched.

The water scorpions belong to the family Nepidae. There are about 20 species spread over 2 genera *Ranatra* and *Laccotrephes*. The genus *Nepa* does not occur in India and is replaced by *Laccotrephes*. The records of *Nepa* quoted above are again a case of misidentification. They occur in shallow waters. They remain concealed at the bottom. They hold the prey with their powerful fore-legs.

Dragon flies belong to the order Odonata. Alikunhi (1957) considers presence of their nymphs in nursery ponds as harmful to the interest of fish fry. The damage caused by them is not likely to be considerable, as they lack the agility of a good predator of fishes. Their normal diet appears to be May-fly larvae as well as smaller examples of their own kind. Mosquito larvae also figure in their food. It is only occasionally that a small tadpole or a small fish is attacked by the large sized larvae of the order Odonata. The study nymphs belong to the suborder Anisoptera and the more slenderly built nymphs belong to the suborder Zygoptera. However they appear to be more important as food of the carnivorous fishes.

Competition between insects and fishes for the available food supply

This is a very complex problem, which has not yet been studied in India. It is well known that both insects and fishes feed on a variety of the same micro-zooplankton. Both fishes and insects such as larvae of *Cybister* and nymphs of Odonata feed on the mosquito larvae. In fact there are many such examples but the effect of such competition has not yet been worked out.

Conclusion

It would thus appear that the studies on the aquatic insects in relation to fisheries should be paid greater attention keeping in view their complex role in the aquatic ecosystem. The study of their beneficial and/or harmful effect is very essential for better production of fishes in India.

Acknowledgements

I am thankful to my colleagues Shri K.S. Pradhan, Dr. A.G.K. Menon, Dr. J.M. Julka and Dr. C.B. Srivastava who have helped with the literature and other courtesies in the preparation of this account. I am also thankful to Director, Zoological Survey of India, Calcutta for his interest in this problem and providing the necessary facilities for work etc.

Literature Cited

1. Alikunhi, K.H. 1957—Fish Culture in India. *Fm. Bull. Indian Coun. agric. Res.*, New Delhi, 20 : 144.

2. Bhimachar, B.S. and Tripathi, S.D. 1966—A review of Culture Fisheries Activities in India. Proc. FAO World Symposium on Worm-Water pond fish Culture, Rome. *FAO Fish Rep.*, (44) 11, 1-32.

3. Bhowmick, R.M. 1969—Studies on some aspects of the Biology of *Glossogobius giuris* (Hamilton) with notes on its fishery in the Hooghly Estuary. *Proc. Indo-Pacific Fish Coun.*, 11 (11) : 99-115.

4. Chacko, P.I. and Kuriyan, G.K. 1948—On the food of nine species of *Barbus* of Madras. *Sci. & Cult.*, 13 (3) : 347.

5. Champlain, A.B. 1923—Fish-killing insects. *Nature Mag.*, 2 : 119-120.

6. Das, S.M., Daftari, S., Singh, H., Akhter, S. Chowdari, S. and Ahmad, N. 1969—Studies on organic production in high altitude lakes of India. Pt. 1 : The general ecology and zoo-plankton of Kashmir lakes. *Kashmir Science* 6 (1-2) : 1-22.

7. Das, S.M. and Moitra, S.K. 1964—Studies on the food and feeding habits of some freshwater fishes of India pt. 4. A review on the food and feeding habits with general conclusions. *Ichthyologica*, 2 (1-2) : 107.

8. Ganguly, D.N. and Mitra, B. 1961—Observations on the fish-fry destroying capacity of certain aquatic insects and the suggestion for their eradication. *Indian Agric.*, Calcutta, 5 : 184-188.

9. Job, T.J. 1941—Food and feeding habits of glass fishes (Ambasis Cuv. & Val.) and their bearing on the biological control of guinea worm and Malaria. *Ind. J. Med. Res.* 29 : 851.

10. Julka, J.M. 1965—Observations on the biology of aquatic bugs (Hemiptera) injurious to the pond fishes. 1. *Anisops bouvieri* Kirkald. *Proc. Indian Acad. Sci.*, Bangalore 61 : 49-61.

11. Karamchandani, S.J. 1957—On the occurrence of associates of carp fry in the fry collection nets and the destructive role. *Indian J. Fish.*, 4 (1) : 47 : 61.

12. Khan, H and Hussain, A. 1947—A note on the destruction of carp fry by larvae of aquatic insects. *Proc. Indian Sci. Cong.*, 34 (3) : 184 (Abstract).

13. Moitra, S.K. 1956—Quantitative studies on the food of some carnivorus fishes of Uttar Pradesh. *Proc. Indian Sci. Cong.*, Pt. III, (Abstracts) : 307.

14. Motwani, M.P. and Karamchandani, S. J. 1958—A note on the food and feeding habits of *Clupisoma garua* (Hemilton) and *Eutropiichthys vacha* (Hamilton) from Allahabad (U.P.). *Curr. Sci*, 27 : 55-56.

15. Mukherjee, H.K., Sengupta, S.N. and Roy Chowdhury 1946—Food and its percentage composition of the common adult fishes of Bengal. *Sci. & Cult.*, 12 : 247.

16. Natarajan, A.V. and Jhingran, A.G. 1961—Index of Preponderance—A method of grading the food elements in the stomach analysis of fishes. *Indian Journal of Fisheries*, 8 : 54-59.

17. Pakrasi, B.B. 1954—Preliminary observations on the control of Aquatic Insects in Nursery ponds, *Proc. Indian Acad. Sci.*, (B) 38 : 211-213.

18. Saigal, B.N. 1970—Fishery and Biology of Cat Fishes in Ganga River system. *Indian J. Fisheries*, Mandapam Camp, 11 (1) : 1-44.

19. Subla, B.A. and Das, S.M. 1970—Studies on the feeding habits, the food and the seasonal fluctuations in feeding in Nine Kashmir fishes. *Kashmir Science*, 7 (1-2) : 25-44.

20. Vaas, D.F. and Uaas-Van, O. 1959—Studies on the production and utilization of natural food in Indonesian carp ponds. *Hydrobiologia*, 12 : 308-393.

21. Vazirani, T.G. 1964—On the morphology and ecology of the larvae of *Cybister* spp. (Dytiscidae : Coleoptera). *Bull. Entom.*, Madras, 5 : 31-48.

22. Vazirani, T.G. 1965—Revision of the Oriental species of the genus *Platambus* Thomson (Insecta : Coleoptera : Dytiscidae) with descriptions of three new species. *Proc. Zool. Soc.*, Calcutta, 18 : 25-34.

23. Vazirani, T.G. 1968—Contribution to the study of aquatic beetles (Coleoptera).
1. On a collection of Dytiscidae from the Western Ghats with description of two new species. *Oriental. Ins.* 1 : 99-112.

24. Vazirani, T.G. 1969—Contribution to the study of Aquatic Beetles (Coleoptera).
2. A review of the subfamilies Noterinae, Laccophilinae, Dytiscinae, and Hydroporinae (in part) from India. *Oriental. Ins.*, 2 : 221-341.

25. Vazirani, T.G. 1969—Contribution to the study of Aquatic Beetles (Coleoptera).
V. Revision of Indian species of *Hyphoporus* sharp (Dytiscidae). *Bull. Mus. natl. Hist. nat.*, Paris, (2) 41 : 203-225.

26. Vazirani, T.G. 1970—Contribution to the study of Aquatic Beetles (Coleoptera). VI. A review of Hydroporinae Dytiscidae, in part, from India. *Oriental Ins.*, New Delhi, 4 (1) : 93-129.

27. Vazirani, T.G. 1970—Contributions to the study of aquatic Beetles (Coleoptera). 7. Revision of Indian Colymbetinae (Dytiscidae). *Oriental Ins.*, 4 (3) : 303-361.

28. Vazirani, T.G. (in press). Dytiscidae collected at light in the Oriental Region. *Bull. Indian Mus.*

29. Wilson, C.B. 1923—Water beetles in relation to bond fish culture, with life histories of those found in fish pond at Fairport, Iowa. *Bull. Bur. Fisheries*, 39 (Document 953), pp. 231-345.

———

Wildlife Losses Due to Diseases in Indian Wild Animals

By

S.K. Sinha

Lecturer in Forestry and Wildlife, Indian Forest College, Dehra Dun

One of the chief objectives of wildlife conservation in natural areas is to produce greater numbers of wild animals on a sustained basis. This is done by utilising the existing production potential and by increasing the productivity through proper management practices. Understanding ecological processes controling wildlife populations is a necessary pre-requisite for prescribing and implementing correct management techniques. Wildlife populations are thwarted in reaching their full breeding potential due to operation of environmental resistance offored to their efferts. Various limiting factors inhibiting expansion and decimating factors causing mortality constitute major elements of environmental resistance. Diseases are one of the five major decimating factors causing mortality among Indian wild animals, other factors being hunting mainly illegal, natural predation by carnivores, starvation which reaches acute proportions during drought seasons in marginal arid and semi arid regions, and less frequently, accidents.

2. Diseases, mainly epidemics of viral and bacterial origin, have, in distant and recent past, caused great losses in Indian wildlife populations, mostly herbivores. Whereas much work has been done on diseases occurring in domestic livestock, almost nothing of the kind has been done in case of wild animals in India. Considerable work has been done in this field in Canada, U.S.A., Switzerland, U.K and even in Africa (Mc Diarmid, 1969). Eight years back, Schaller (1967) noted that, in India, even the most rudimentary forms of ecological research, such as making accurate annual censuses and determining rates of reproduction and mortality in wild animal populations were non-existent. Since then, the situation has remained almost unchanged, the only notable exceptions, all directed, executed and financed by foreign agencies, being Schaller's own work in Kanha carried out during 1963.65, of Joslin, Hodd and Berwick carried out under Gir Lion Ecological Project during 1966-71, and works on Lion-tailed macaque by Sujiyama, Karr and Stevan Greens and on Siberian Crane by Ronald T. Sauery carried out mostly in 1970s. Of these, Schaller is the sole worker who systematically devoted to a study of diseases occruring in the free-driving wild animals.

3. In India, epidemics in wildlife populations have been of frequent occurrence. Most of them have gone unrecorded. Available accounts mentioning them do so in a rather sketchy manner. Even the recent outbreaks of rinderpest in South India during

1968 & 1975 which wiped out practically entire populations of gaur or Indian bison (*Bos gaurus*) or of haemorrhagic septicemia in Sariska (Rajasthan) that wiped out large population of Sambhar (*Cervus unicolor*) and Nilgai (*Boselaphus tragocamelus*) in 1970-71 have not been reported. The following survey of diseases in wildlife population is based substantially on available literature. Information has also been gathered from S. Deb Roy, IFS of Assam Cadre who had also investigated about anthrax outbreak of 1968 in Goalpara District of Assam, and from Dr. G.K. Sinha, former Professor of Veterinery Medicine at Pantnagar Agricultural University (U.P.). Information pertaining to haemorrhagic septicemia in Sariska were personally collected by me during a tour of Sariska in June 1975 from Jai Singh, Dy. Chief Wildlife Warden, Rajasthan and K.L. Saini, Asstt. Conservator of Forests, in Rajasthan Forest Service, both of whom were working in Sariska Sanctuary during the 1970-71 boutbreak.

4. The available literature on diseases do not cover all the wildlife habitats of India. The account attempted here, therefore, is imcomplete inasmuch as details of numerous known outbreaks in the past could not be obtained while writing it. The most virulent epidemics have been rinderpest, foot-and-mouth diseases, anthrax, and haemorrhagic septicemia. Endemic diseases have not been widely reported though their possibility, chiefly due to mineral deficiencies, cannot be ruled out. However, direct losses due to mortality from endemic diseases does not appear to be large as evidenced from lack of references in available records on diseases in wild animals. Practically nothing has been reported about diseases occurring in wild birds, fishes and reptiles though it is reasonable to suspect that increasing use of insecticides and herbicides would be having harmful effects on birds and aquatic wildlife populations. Studies in this direction are wanting for Indian wildlife populations.

EPIDEMIC DISEASES

Foot-and-Mouth Disease

5. *Foot-and-Mouth Disease* (Epizootic Aphthae: Aphthous Fever)

Caused by an ultranicroscopic virus, is an acute, highly conagious, vesicular eruption of the mouth, feet, and teats affecting all cloven-footed animals (Udall 1954), but chiefly cattle, pigs, sheep and goats. All wild ruminants are highly susceptible to it. It is the most contagious of animal epidemics, and exposed animals are invariably attacked (Udall, 1954) which explains recurrent serious outbreaks of the disease. Its occurrence among wild animals in India is country wide and has been reported in Andhra Pradesh (Ali, 1953), Karnataka (Neginhal, 1974), Madhya Pradesh (Schaller, 1967; Ali, 1953), Hazaribagh and Indo-Nepal Border (Dr. Sinha, pers comm) Kashmir and Himalayan Ranges

(Editors, 1927) in Palamau in Bihar (Deb Roy, Pers. Comm). and in Taroba National Park in Maharashtra (Chowdhary, Pers. Comm).

6. Many wild species of ruminants are affected by this disease. 15-20 bisons were reported to die from this disease contacted from village cattle penned in the Biligirirangan Hills (Karnataka) (Morris, 1952). Chital (*Axix axis*) round about Bandipur are sometimes affected by this disease during the rainy seasen (Neginhal, 1974), Usually the wild animals catch this disease from infected domestic cattle grazing in the forests or bullocks passing through the forests while transporting sugarcane as in Terai forests (Dr. Sinha, pers. comm.), by slaughter animals passing through forests as in Bandipur reserve (Neginhal 1974). Humans can also spread this disease through contact with infected animals. Water holes and grazing grounds are usual sources of spread.

7. *Symptoms*—The period of incubation is from 18 hours to 3 weeks. Temperature rises from 2 to 3 degrees F. a few hours before other symptoms become apparent. Vesicles are found in mouth. Smaller thin-walled blisters appear on lips, cheeks, and dental pad while the larger ones upto 5 cm in diameter are thick walled and appear on the dorsal surface of the tongue. The blisters soon rupture, usuaslly the same day leaving a denuded, red painful surface. Salivation increases and drools freely from the closed lips. Healing of denuded areas and recovery in case of uncomplicated cases take place in 10 to 20 days. Vesicles on the feet, formed usually as a result of infection caused by dropping of saliva on feet while walking, accompany or follow the eruption in the mouth. If untreated, mortality may reach 30 to 40 percent, about 10 percent may recover while the rest will go down in health permanently. Losses are heavy in all countries where the disease is permanently established (Udall, 1954). Heavy losses were caused in 1955 outbreak in Hazaribagh (Dr. Sinha, pers. comm.).

8. *Control*—As a prophylactic measure vaccination of all domestic grazing cattle entering forests as has been practised in some areas such as on Bihar-Nepal border (Dr. Sinha pers. comm.) can prevent the most common source of infection of wild ruminants. After outbreak, vaccines and serums are used for treatment. Wide spectrum antibiotic drugs have been used in treatment of domestic stock in India. More drastic control measures in the case of an outbreak such as strict quarantine, disinfection and even slaughter are resorted to in the United States, while vaccination was reported to be effective in the 1946-52 outbreak in Mexico (Udall, 1954).

Rinderpest

9. Rinderpest, also known as cattle plague or oriental rinderpest, is a highly contagious general disease of cattle and through them of wild animals chiefly bison and dear in India,

characterised by high mortality reaching as high as 90% (Krishnamurthy, 1973). The young are most susceptible. It is caused by a filterable virus. Wild ruminants are less susceptible than cattle (Udall, 1954) but bison appears, in India, to be most susceptible of all. It is of historical interest due to its leading position among cattle plagues from about the fifth century onwards resulting in devastation of cattle from entire areas of Europe from where it was finally eradicated only in 1880 (Udall, 1954). The disease is chiefly prevalent in Asia and Africa. In India, it is prevalent all over the country.

10. Undoubtedly, rinderpest appears to be the greatest killer epidemic amongst the Indian wild animals. F.W. Champion (1927) reports outbreak of rinderpest (c. 1927) in Lansdowne forest division of Uttar Pradesh when he observed greater mortality among deer hinds than in stags. Large tracts of wildlife areas have been known to be cleared by rinderpest in Chilla and Khara ranges in U.P. in 1906 outbreak (Singh 1972), in Andhra Pradesh (Ali, 1953), large number of bison and wild buffalo (*Bubalus bubalis*) were killed in Peninsular India (Editors, 1927; Schaller, 1967). Gee (1955) reported death of wild buffaloes in Kaziranga National Park of Assam in 1952 from rinderpest. and of 'countless' cheetals, also probably of sambar, hogdeer (*Axis porcinus*) and barking deer (*Muntiacus muntjac*) in Corbett National Park during severe outbreaks of the epidemic in 1942 and 1947. Neginhal (1974) reports Bandipur tiger reserve as having the 'worst' history of rinderpest which is substantiated by heavy losses among bisons in 1968. The 1968 outbreak was spread over contiguous areas of Mudumalai where in the sanctuary area alone 78 bisons died due to the disease. Mudumalai and Thekkady bisons suffered from heavy mortality in 1974-75 outbreak, believed to be of rinderpest by the investigating team of veterinarians from the Indian Veterinary Research Institute, which visited Thekkady in March 1975. Schaller (1967) mentions a virulent epidemic of rinderpest killing many gaur and barasingha (*Cervus duvauceli*) in the Kanha National Park in the years 1925-26, and wiping out of a population of black buck (*Antelope cervicapra*) that was once found just west of Chilka lake in Orissa in the early 1940's.

11. *Spread of disease.* Udall (1954) mentions that method of infection is chiefly by contact with diseased animals or their products, such as flesh and hides and he considers transmission of disease through intermediate carriers, such as food, water, etc. improbable. Infection, he states, occurs in digestive tract, and the chief spread is along lines of cattle movements. The virus is present within the body of the diseased animal in its blood, tissue fluids and all secretions and excretions, rendering easy the detection of disease through stool examination. The virus does not survive outside the body and is also destroyed by exposure to air, sunlight, putrefaction, temperature of 60°C, and weak disinfectants (Udall, 1954.)

12. *Symptoms.* Dr. Krishnamurthy (1973) described the symptoms as observed in Indian bison to be; isolation of the diseased animal from the herd, stoppage of feeding, salivation from mouth, lethargy, rise in temperature shooting as high as 106°F and general depression. Diarrhaea develops after 3-4 days causing severe dehydration due to which the diseased bison moves to water holes. Blood may be present in stools. Death follows within another 2-3 days. Post mortems have revealed characteristic ulceration of upper and lower mouth following profuse salivation—a condition which often leads to mistaking the symptoms to be of foot-and-mouth disease. Mouth smells foul and necrosis may be present. The feces which are watery thin are peculiary fetid which permits rinderpest to be smelt even from a distance. In some fatal cases diarrhaea and ulceration of mouth were absent but the disease was confirmed by blood tests carried out on them. In Mudumalai, deer and sambhar as also goats and sheep were not detected to be afflicted with the disease during the 1968 outbreak of Rinderpest. He also stated that in case of virulent attacks of the epidemic upto 90% bisons have been wiped out while within Mudumalai Sanctuary 1700 domestic cattle out of 1800 perished in 1968.

13. In general, the most distinctive symptoms are the high continuous fever, erosions in the mouth with grayish-yellow deposits, severe intestinal attack, and rapid emaciation (Udall, 1954).

14. *Control.* In India, for domestic stock, goat-tissue virus is used extensively in immunization against rinderpest for prophylaxis and in actual outbreaks. Serum is sometimes given with vaccine to check reactions and goat-blood virus is also used (Udall, 1954). Failure of virus to survive outside the body makes the control of rinderpest relatively easy through immunization programmes as apparent, for instance, from results obtained in Assam, especially around sanctuaries of Kaziranga and Monas where inoculation of domestic cattle, done every alternate year by the Animal Husbandry Department, has prevented outbreaks of rinderpest in the past few years (Deb Roy, pers. comm.). Trial of very high doses of broad spectrum antibiotics and sulpha drugs are suggested (Dr. Sinha, pers. comm.) in treatment of disease affected animals. For effeective prevention of rinderpest eruption among wild populations the measures recommended are: (i) effective disposal of carcases of diseased animals by burning; (ii) covering feces of diseased animals with quick lime; (iii) periodic vaccination of all domestic stock residing or entering in the sanctuary, with exception of calves below 6 months and pregnant cows and (iv) suspension of grazing by domestic animals inside the forest area (Krishnamurthy, 1973).

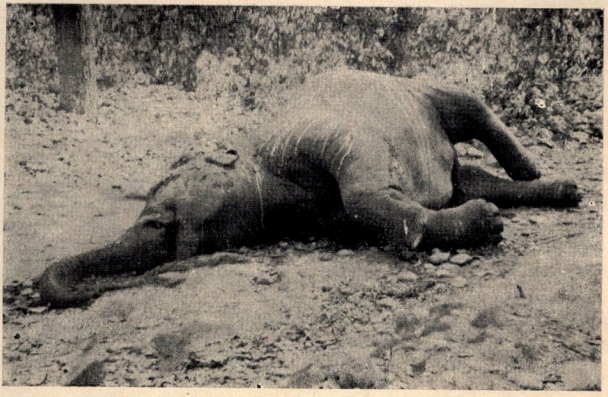
Anthrax

15. Anthrax, also termed splenic fever or charbon is an acute bacterial disease caused by *Bacillus anthracis* and characterized by enlargement of the spleen. All animals, wild

and domestic, are susceptible. In India, it is present throughout the country. In Assam, as many as 150 wild elephants are believed to have died in the North Cachar Hills in 1949 from the disease as also many rhinos that died in Kaziranga National Park in 1944 and 1947 (Gee, 1955). Krishnamurthy (1973) stated that every year 1 to 2 deaths occur among elephants in Tamil Nadu. Neginhal (1974) reports absence of the disease from Bandipur Reserve.

16. Deb Roy (pers. comm.) mentioned occurrence of severe outbreaks of this disease in Assam in 1957-58 and again in 1968. During 1957-58 outbreak which was most active in Assam during winter the infection was brought by wild animals from the adjoining forest areas of North Bengal spreading in parts of lower Assam, especially in Goalpara district and Somej in Kamrup, its further spread being checked by the Monas river. The wild species affected were bison, chital, hog deer (*Axis porcinus*), barking deer, sambhar and a very small number of elephants and wild pigs (*Sus scrofa*). The disease was peracute and most deaths occurred within 24 hours of appearance of symptoms which included very high temperature, shivering and immobilization, and bleeding through nose, mouth and anus. The worst sufferer was chital population which has not been able to make up even uptil now (1975). "Animal population, on the whole was greatly reduced and the rotting death bodies filled whole jungle with stench," said Deb Roy. After about 2-3 months, the disease subsided by itself. As a precautionary measure, domestic cattle from some surounding revenue villages and forest villages were inoculated. The epidemic also travelled through in the contiguous forest areas of Bhutan. The 1968 outbreak was milder in comparison to the previous one. The disease, as before, came through North Bengal forests and affected only parts of Goalpara district. The largest mortality was among bison this time. Some sambhars died, while no deaths were observed in Elephants. The disease was not noticed in time and by the time Forest Department initiated action the disease had ended by itself.

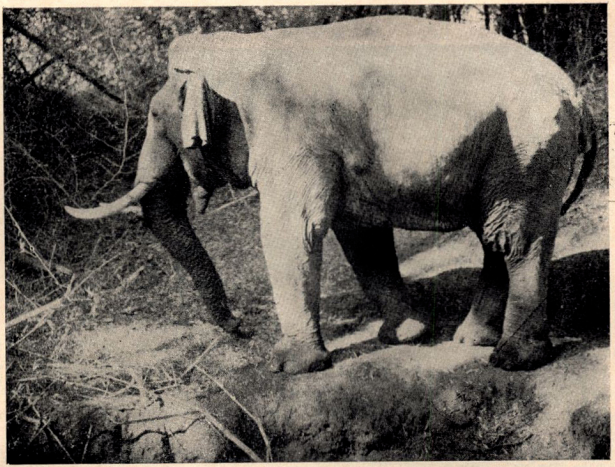
17. K.V. Kakkar (pers. comm.) inspected dead bodies of two elephants in April 1975 while investigating sudden deaths of 4 elephants in Motichur range of Dehra Dun (East) division. On personal examination he observed "signs of blood having come out of their sex organs. There was no sign of any bullet injury, nor was there any sign of a fight between the elephants having taken place. The bushes and saplings near the area were undisturbed." He interrogated one of the forest labourers who claimed to have seen one of the elephants dying. The latter said that the elephant's "whole body gave the appearance of shivering and it fell down. It again got up, moved a few yards, and again fell down—dead." During the investigation he was accompanied by two veterinary doctors of Dehra Dun. The visceral contents have been reportedly sent to the Chemical Examiner, Agra. The results are yet awaited. The circumstantial evidence, however, points at the possibility of the deaths to be due to peracute form of anthrax. A plate



Elephant death due to Anthrax (?) in Motichur Range of East Dehra Dun Division. White streaks are the droppings of vultures that visited the carcass.

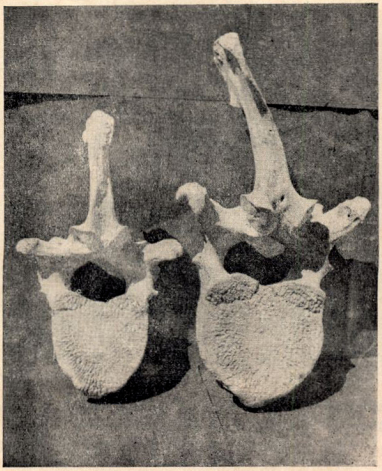
Elephant death due to Anthrax (?) Note the blood from rear openings. Motichur Range, East Dehra Dun Division.

Photos by : K.V. Kakkar, I.F.S., Dean, Indian Forest College.



Bumpty — *Photo by:* E.R.C. Davidar

(*See Page 42*)



Dorsal vertibrae of an Indian wild elephant

(*See Page 45*)

showing two photographs, taken on the spot by him shows, rather faintly, the flow of blood (white streaks on the body are dve to droppings of vultures which visited the carcases).

18. *Modes of Infection.* Infection in animals occurs through soil, ingestion, biting insects, wound, and in humans by handling hides, hair, wool and bones or using cheep shaving brushes or through inhalatton (Udall, 1954). Once the soil becomes infected with the disease causing bacteria, it remains so for years. Improper disposal of diseased cadavers can be considered as the biggest source of soil infection. The *spore* form of the bacteria exists permanently in the soil. Spores are formed, in presence of air, in the feces of the sick animals. Spores are carried in water, roughage, grain and animal products such as hides, brushes, vaccine, bone meal, bones, etc. In 1952, 100 tons of bone meal imported from Belgium caused widespread infection in the United States as described by Udall, (1954). Infected pastures and streams are the main sources of infection through ingestion which is further aggravated during hot, drought periods which force drinking of polluted water and close grazing both by domestic and wild animals. Birds are also carriers of the infecting bacteria.

19. *Symptoms.* In peracute anthrax, usually occurring in the beginning of the outbreak, convulsion may occur from a few minutes to 2-3 hours. Bloody foam is often expelled from the mouth and nostrils, and blood from anus and vuiva (Udall, 1954). In acute form, death may occur within 1 or 2 days from the appearance of symptoms which may include high rise of temperature, above 100°F. being fatal in elephants (Krishnamurthy, 1973) and reaching upto 105 to 107°F in cattle, pneumonia, convulsions and bloody evacuation. No remedy is yet found for peracute and acute cases; death is certain. Subacute form of the disease shows high rise of temperature, pneumonia, oedema or accumulation of fluid in tissues, and blood evacuation. Body openings often show tarry dark blood. Postmortem examinations of diseased animals significantly reveal failure of rigor mortis, bloody foam at the body openings, haemorrhages throughout the body, and *enlargement of the spleen* (Udall, 1954).

20. *Treatment.* Prophylatic treatment includes use of Pasteur vaccine, introduced by Pasteur in 1881, anthrax-spore vaccines, and anti anthrax serum. For treatment of disease affected individuals antianthrax serum and penicillin has proved to be successfal in the case of anthrax in both animals and man (Udall, 1954).

21. *Control.* For preventing or checking spread of anthrax in wild animals the measures recommended are (i) burying of disease affected dead bodies in about 2 metre deep pits dug in seepage free ground and spreading of quicklime inside the pit to prevent earth worms from bringing spores of pathogenic bacteria to the surface, (ii) vaccination of livestock grazing by outside domestic cattle during actual periods of outbreak.

Haemorrhagic septicaemia

22. Haemorrhagic septicaemia or pasteurellosis is the name of a group of infectious, usually acute, bacterial diseases caused by *Pasteurella multocida*, and affects cattle, deer, pigs, sheep and birds and is characterized by haemorrhages in the internal organs. The worst known outbreak of the disease in India has been in the Sariska wildlife sanctuary, Rajasthan where over 1500 sambhars perished during 1970-71. It is noteworthy that in the United States, this disease is gradually spreading (Udall, 1954).

23. In Sariska, the outbreak was so severe that in a period of about one year 1500 sambhars died (Jaising, pers. comm.). A class of 6 trainees of Wildlife Education Course at Forest Research Institute which toured Sariska in March 1971 counted, on 4th March, 61 sambhar carcases--7 males, 36 females and 18 fawns in mere 1400 steps along Bandipul nala and it also observed many sambhar and nilgai carcases on way to Pandupole but failed to notice any spotted deer carcase (Shaikh, 1971). An investigation of the outbreak was carried out by the Veterinary Disease Investigation Officer Jaipur (Rajasthan) who, after laboratory examination of morbid material from carcases, pronouneed the epidemic to be due to haemorrhagic septicaemia (His letters No. 505 dt. 26-11-70 and No. nil dated 27-11-70 addressed to the Warden, Sariska Game Sanctuary). The disease could not be checked despite vigorous efforts of the sanctuary staff who used great quantities of Terramycin drug, mixing them with water at the water holes, as suggested by the Disease Investigation Officer. The forest staff was sick with the stench that rose from the putrid carcases and exhausted from daily mass burning of dead bodies of animals, mostly sambhar (Saini, pers. comm).

24. *Symptoms*. In case of sambhars in Sariska, there were apparently no external symptoms observed in case of dying animals. The *Pasteurella* group of bacteria are found in tissues of all normal animals in the upper respiratory tract and the digestive tract. Udall (1954) describes the characteristic symptoms as: prostration, drooping ears, congested or haemorrhagic mucosae, lachrymation, fast pulse rapid breathing, a temperature of from 104 to 106°F. with chills, extreme difficulty in breathing marked by extended head, open mouth and protruded tongue. Disease appears to break when the general conditions of animals is weakened.

25. *Treatments*. In case of Sariska outbreak, the Disease Investigation Officer, Jaipur prescribed (i) Terramycin feed supplement mixed in a mash; (ii) Terramycin animal formula (soluble powder) in drinking water; (iii) disinfection of ponds and streams with potassium permanganate; (iv) thorough sprinkling of carcases with disinfectant such as phenyle or lysol. and (v) exclusion of domestic livestock from sanctuary area. However, as mentioned earlier the treatments did not check the deaths from disease and eventually the

disease ended by itself. Udall (1954) has suggested use of septicaemia serums, penicillin, and various sulpha drugs for treatment of sick cattle. For prophylaxis vaccination against haemorrhagic septicaemia is used, as in case of all domestic cattle grazing in Mudumalai Sanctuary (Krishnamurthy, 1973).

26. *Control.* Proper disposal of carcases in case of outbreaks and vaccination of domestic cattle grazing in wild animal areas in normal years appear to be the most important control measures.

Other Physical Diseases

27. *Rabies or hydrophobia* is a viral disease transmitted through wounds in body by carriers which include beside domestic dogs, many other vectors namely, jackal, wolf, hyaena, fox, wild dog, man, monkey, cat, leopard, wild cat, cow, tiger, buffalo, horse, mule, donkey, camel, sheep, goat, pig, rabbit, guinea-pig, mongoose, rat, bear, deer, elephant, cheetah, lion, bullock, calf, fowl, as revealed by the records maintained by the Pasteur Institute of Coonoor (Tamil Nadu), for the years 1908 to 1948 inclusive during which they treated 263, 736 rabies patients (Anon. 1951). Wild dogs are perhaps checked in their population growth by periodic outbreaks of rabies (Singh, 1973). Figures about deaths in wild populations from rabies are not known but they are not likely to be significant by any reckoning.

28. *Brucellosis* (*Contagious Abortion: Bang's Disease*) is caused by bacteria *Brucella abortus* which brings about degenerative changes in the pregnant uterus, the fetal membranes, and the foetus (Udall, 1954) finally causing abortion. Schaller (1957) reports occurrence of this disease in the barasingha population of Kanha park lowering reproduction.

29. *Cattle Tuberculosis.* Chital are known to suffer from this disease (Schaller, 1967).

30. *Parasites.* Ectoparasites such as ticks and mites are found to occur among most wild animals. Their increased activity can lead to anaemia and skin injuries. Endoparasites such as various nematodes (round and thread worms), trematodes (flatworms), liver fluke etc. can prove fatal but such cases would be very limited. Deb Roy told me of death of five captive elephants from liverfluke, four in Kaziranga. Postmortem of one elephant showed partially eaten up liver with thousands of live liverflukes infesting it. I was told of a lion-cub that died in Sukkurbagh zoo in Junagadh whose postmortem revealed the intestine to be literally choked with round worms. Deworming is a routine treatment for carnivores in all good zoos.

31. *Fungal infections.* Fungal infections are common in wild elephants of Assam (Deb-Roy, Pers. Comm.). Skin area around navel is infected which causes itching that is often relieved by scratching with foot or rubbing against tree trunk or even ground. Ring-

worm has been reported in many wild animals (McDiarmid, 1969). Environmental role of fungal infections in Indian wild animals has not been assessed.

31. *Disorders of Metabolism.* Mineral and vitamin deficiencies are often noticed in the field among wild animals.

32. *Diseases in Birds.* Ranikhet or New Castle disease is a viral disease affecting gallinacedus birds such as jungle fowl, peafowl, partridges and myna while ducks are resistant to it. No treatment is available.

33. *Gangrene*: Sporadically, wild animals die from wounds received by them during their inter-or intra-specific fights, accidents, or hunting on wounds turning gangrenous. One of the best-known Gir lion, Tilia, had died due to a non-healing wound inflicted in its forehead during a fight with another male lion. While such losses are insignificant for large populations, they could be significant, and sometimes critical, in case of rare or threatened species.

Stress Diseases

34. *Stress diseases.* Invariably, while considering diseases among free-living wild animals in India, diseases originating from or accentuated by stress conditions are ignored, though in case of captive animals their importance is recognized (Anon. 1975). Stress is an important factor in wildlife disease and it should be emphasised that this is brought about by habitat relationships that are associated with many diseases as observed by C.M. Herman (McDiarmid 1969). Stress caused by extensive Eucalyptus plantations in Terai forests of U.P. raised after destroying existing forest ecosystem, and shrinking forest area in Palamau region in Bihar has disrupted social organizations of wild elephants resulting in increased intra-specific aggression, depredation in village croplands, destruction of property, and even killing of humans. In Palamau Park, S.R. Chowdhury, ex-SRO (Wildlife) has seen and photographed a dead body of a man who was literally skinned by an elephant as if it had peeled off a banana skin. I saw that photograph in Dehra Dun in 1973. A heavy motor-truck of Palamau wrs very badly battered by an irate elephant. Excessive visitation by humans in forests, such as sanctuaries or park areas, cause behavioural disruptions among sensitive wild species. A tigress, healthy, about 9 years old, which stays in the most frequented part of Palamau national park has failed to breed (Deb-Roy, Pers. Comm.)

35. Spillett (1966) refers to disturbances, intolerable to some wild animals, caused by presence of herders and other people occasioned by grazing of domestic live stock, especially during some critical times like mating or calving periods. Such undue disturbance may so alter the normal behaviour patterns of some wild animals that they will dwindle in numbers and eventually disappear from an area. I observed a young Gir lioness with

two cubs she had delivered in forests within 200 metres of village fields and hardly 50 metres from a well frequented forest road starving for over a week because she could not leave the cubs due to excessive human and cattle disturbance in the area. Some animal species must undergo prolonged courtship periods or exhibit elaborate displays before successful mating; any disturbance during these periods can result in failure to mate successfully.

36. To ensure high success of breeding, especially of rare or threatened species such as lion and tiger, it would be useful to mark potential breeding areas and prevent human or cattle disturbance there. Such breeding areas, if degraded, can be made more attractive to wild animals by artifically planting bushy species, etc., favoured by the particular species.

Diseases in Captive Wild Animals

37. This paper is aimed primarily at a survey of diseases among free-living wild animals. Yet it would remain incomplete without pointing at the diseases prevalent among captive wild animals for the single reason that zoos have a great role in breeding rare animals for the purpose of later release in wild areas, a practice proved successful in other countries (Martin, 1975). Thamin or Manipur deer (*Cervus eldi*), tiger (*Panthera tigris tigris*), lion (*Panthera leo persiea*), musk-deer (*Moschus moschiferus*) are some of the illustrative examples of Indian wild mammals that have become rare and whose multiplication in captivity will be a very valuable insurance against their total extinction. It is with this object in view that importance has to be given in study of diseases in captive animals.

38. C.L. Bhatia, former Director of Delhi Zoological Park, told me of an instance when 7 tigers were lost in Delhi Zoo park during a single week due to outbreak of gastro-enteritis. Over 10 great Indian bustards captured from Barmer deserts perished in Jaipur zoo, most probably due to stress. Black buck in Sikandra reserve (U.P.) are perhaps suffering from malnutrition. Animals of Madras Zoo have been suffering from respiratory diseases caused by polluted air. Undernourishment, mineral and vitamin deficiencies, and anxiety syndrome were noticed by me in many animals of Lucknow Zoo in 1974.

39. *Elephants in Captivity.* Elephants are a single species which have been captured from wild and domesticated for purposes of transportation, war, shikar and also as a status symbol in India for atleast 25 centuries now as evident from old Pali and Sanskrit texts. There is even an old sanskrit treatise on elephants that has been also translated in Tamil indicating its usefulness. Their diseases have been perhaps most attended to among all wild animals in captivity. Most common ailments are worms in calves, and also in adults. In Assam domestic elephants often suffer from liverfluke infections which, the local mahauts believe (Deb Roy, Pers. comm.), are caught by the animals while eating

Dal grass that occurs in swamps. Other common ailment, very uncomforlable for the elephants, is a tender condition of undersurfaces of feet. It is known by different local names, e.g. 'Kari' in Assam and has been reported from Maharashtra and Kerala also. Practically each experienced mahaut has his own formula for treatments and significantly many such formulations are indeed effective. However, with the availability of highly effective sulpha drugs, penicillin, broad spectrum antibiotics antiseptics, treatments have become now surer and easier, if not cheaper, than in the past.

40. *Musth* in elephants has been a phenomen on that has been highly controversial and practically all sorts of imaginative cures have been tried, some of them effectively. Musth is an oily discharge from the musth glands, normally inconspicuous, lying one on each side of the head, midway between the eye and ear. Widely held opinion associates musth discharge with a state of supercharged sexual excitement confined to male elephants, usually lasting about 10 days (Marshall, 1959), Females also have musth glands, but in them discharge is limited when on heat or at the time of calf-birth, and are not associated with any violent gestures as reported by Marshall (1959) in case of elephants in Thailand. The Thai formula, he writes, is mostly overworking the musth male elephants, often at grave risks to the mahuat and other elephants, and then tying it to a large tree and handfeeding the elephant for a few days. As in case of other elephant ailments, many formulas are concocted by mahauts for treating musth some of which require many items such as even brandy, obviously not for the elephant, as was narrated once by S.C. Thippeswamy, now a Conservator of Forests in Karanataka. No single effective formula is known.

Conclusion

41. While surveying diseases among wild animals in India, the apalling inadequacies existing in methods of detection and treatment become shockingly apparent. Central and State Governments have, happily, become aware of the values of wildlife and sanctioned expenditures of many millions of rupees in its canse. But, curiously, and to the great detriment of wildlife, there is no sense of urgency prevailing regarding the diseases that have wiped out whole populations of wildlife in India. This is evidently because no officials exist with exclusive responsibility for conducting investigations and researches in matters pertaining to wildlife. In this respect, a resolution recently passed by the Executive Committee of the Wildlife Preservation Society of India on 17th July 1975, urging central and various state gevernments to create post of Wildlife Research Officer in each state, is a pointer for the evident need of research in wildlife. Similar resolution was also passed by the Tourist Development Council at its XVth Meeting. Even at the central level, there is

no officer who is solely designated for wildlife research, either at the Forest Research Institute or at any other institute.

42. The need for research becomes evident when one is informed that even small countries like Hungary, Switzerland or East African states have separate Wildlife Research Institutes devoted to, inter alia, wildlife disease studies. In principle, Government of India has through the official Draft Science and Technology Plan admitted, the need for a wildlie Research Institute estimated to cost Rs. 3 million. In view of the facts that we in India have rather been unable to conduct any wildlife studies, let alone research, the need for an independent Wildlife Resea r ch Institute, may be on a very small scale to start with if difficulties of trained staff or funds are experienced, is self-evident.

43. The national park/sanctuary authorities should be provided with capchur gun, capchur pistols, and adequate stock of sedatives, tranquilizers, medicines, etc. in case of need in treating or isolating disease affected or wounded wild animals. Necessary training should also be provided to them for using the capchur gun and treating the animals. At present, hardly any park/sanctuary, with exception of Gir and perhaps some others, have these facilities.

Acknowledgements

I gratefully acknowledge the assistance received in compiling information for this report from Shri S. Deb Roy, SRO-cum-Lecturer, FRI Dehra Dun, Dr. G.K. Sinha, former Professor of Veterinary Medicine Pantnagar Agricultural University, Shri Jai Singh, Dy. Chief Wildlife Warden, Rajasthan, Shri K.L. Saini, Asstt. Conservator of Forests, Alwar, Shri M.F. Ahmed, my colleague at the Indian Forest College for providing lecture notes of Dr. Krishnamurthy and Shri R.L. Chowdhary, Lecturer at the Indian Forest College.

Special thanks are due to Shri K.V. Kakkar, IFS, Dean, Indian Forest College, Dehra Dun for providing information and two photographs pertaining to death of elephants in East Dehra Dun division where he was D.F.O. during the period of investigation.

References

1. Ali, S.C. (1953). Hyderabad State, pp. 82—89—*In* The Preservation of Wildlife in India: A compilation. Edited by R. Burton, Bangalore.

2. Anonymous (1951). 'Rabies in Tiger'—a discussion. Jour. Bom. Nat. His. Soc. Vol. 50(2).

3. Anonymous (1975). Management of Zoos in India—Report of the Expert Committee on Zoos. Indian Board for Wildlife. New Delhi.

4. Champion, F.W. (1927). With a camera in Tigerland. Chatto and Windus, London.

5. Editors (1927). Game Preservation in India—Editorial. Jour. Bom. Nat. His. Soc. Vol. 32 pp 359-365.

6. Gee, E.P. (1955). Management of India's Wildlife Sanctuaries and National Parks, Part II. Jour. Bom. Nat. His. Soc. 52(4) pp. 717-734.

7. Krishnamurthy, V. Forest Veterinary Officer, Coimbatore, Tamil Nadu (1973). Lecture on diseases among wild animals delivered in June 1973 at FRI, Dehra Dun (unpublished).

8. Marshall, H.N. (1959). Elephant Kingdom. Robert Hale Limited, London.

9. Martin, R.D. (1975). Ed. Endangered Species Captivity. Academic Press, London.

10. McDiarmid, A. (1969). Ed. Diseases in Free-living Wild Animals. Academic Press. London and New York.

11. Morris, R.C. (1952) Miscellaneous Notes. Jour. Bom. Nat. His. Soc. Vol. 32.

12. Neginhal, S.J. (1974). Project Tiger, Bandlpur Reserve. Govt. of Karnataka, Forest Deptt, Bangalore.

13. Schaller, G.B. (1967). The Deer and the Tiger. The Univ. of Chicago Press, Chicago and London.

14. Shaikh, K.A. (1971). Tour Journal of Rajasthan-Gujrat Tour, Wildlife Education Course, Forest Research Institute and Colleges, Dehra Dun (Unpublished).

15. Singh A. (1973). Tiger Haven. Macmillan, London.

16. Singh, Kanwar Jit (1973). Management Plan of Chilla and Khara Wildlife Range—an exercise by Wildlife Education Course at Forest Research Institute, Dehra Dun (Unpublished).

17. Spilett, J. Juan (1968). Wildlife Conservation Problems in India. Jour. Bom. Nat. His. Soc. Vol. 63(3).

18. Udall, D.H. (1954). The Practice of Veterinary Medicine, Oxford Book Co. Delhi. Indian Ed. 1964.

———

Fish Fauna of Corbett National Park, Uttar Pradesh

By

Akhlaq Husain

Zoological Survey of India, Dehra Dun

Introduction

The Corbett National Park is famous for its wildlife especially elephants, tigers, leopards, deers, crocodiles, partridges etc. but so far very little attention has been paid as regards the fish fauna which is also of equal significance. Considerable interest has been shown in the fish fauna of the areas adjoining the Park (Day, 1878; Walker, 1888; Hora, 1937; Raj, 1945; Menon, 1949; Tilak, 1969 and Pant, 1970). Seeing the paucity of information about the fauna of the Park, Zoological Survey of India, Dehra Dun undertook exhaustive faunistic surveys. The present paper is an outcome of this effort and deals with the fish fauna of the Park and based in preimpoundment survey.

History and Topography of the Park

The Park was the first to be established as National Park in India in the year 1935 and was named as Hailey National Park in honour of Sir Malcolm Hailey, the then Governor of Uttar Pradesh. Later, its name was changed to Ramganga National Park after the name of the river Ramganga which flows through the Park but in 1957, it was renamed as Corbett National Park in memory of Jim Corbett, the renowned sportsman and naturalist.

The park covers an area of 525.8 sq. km. along the foothills of Kumaon Himalaya and lies in Pauri Garhwal and Nainital districts. The average altitude of the main valley or *Putlidun* is 400 metres above mean sea level, while that of the surrounding hills varies from 700-1500 metres approximately. The river Ramganga, originating from Kumaon Himalaya, passes through the main valley and enters the plains at Kalagarh. The smaller streams in the Park flow with scanty water; those of the southern half have sandy bed strewn with stones while those of the northern part have stony bed. There are many seasonal nallas in the Park which are alive only during rains.

Localities Surveyed

(1) River Ramganga at Sultan, Gairal, Sarpduli, Dhikala and Boxar Forest Rest Houses.
(2) A stream near Dhangarhi gate.
(3) Gajar sot near Sultan Forest Rest House.
(4) Dhulva sot on Sultan-Sarpduli Road.

(5) Ranibagh sot near Gairal Forest Rest House.
(6) Gorkha sot near Sarpduli Forest Rest House.
(7) Jaman sot near Sarpduli Forest Rest House.
(8) Mandal nala near Kanda Forest Rest House.
(9) Kanda nala near Kanda Forest Rest House.
(10) Jaraka sot near Boxar Forest Rest House.
(11) Paterpani nala near Paterpani Forest Rest House.
(12) A stream on Gaujpani-Malani road.
(13) Jhirna nala near Jhirna Forest Rest House.
(14) Dhara nala near Jhirna Forest Rest House.
(15) Jumnagwar nala near Jumnagwar Forest Rest House.
(16) A small stream near Malani Forest Rest House
(17) Paniagar sot near Bijrani.
(18) Bijrani sot near Bijrani Forest Rest House.
(19) Garjia sot near Bijrani Forest Rest House.

Systematic List

Class : Osteichthyes
Sub-class : Actinopterygii
Division : III
Superorder : Ostariophysi
Order : Cypriniformes
Sub-order : Cyprinoidei
Family : Cyprinidae

(1) *Barilius barna* Hamilton
(2) *B. bendelisis* Hamilton
(3) *B. bola* Hamilton
(4) *B. vagra* Hamilton
(5) *Brachydanio rerio* (Hamilton)
(6) *Danio devario* Hamilton
(7) *Esomus danricus* (Hamilton)
(8) *Chagunius chagunio* (Hamilton)
(9) *Rasbora danicounius danicounius* (Hamilton)
(10) *Puntius ticto* Hamilton
(11) *P. conchonius* Hamilton

(12) *P. sophore* Hamilton
(13) *Tor chilinoides* (McClelland)
(14) *T. putitora* (Hamilton)
(19) *T. tor* (Hamilton)
(16) *Crossocheilus latius* (Hamilton)
(17) *Garra gotyla gotyla* (Gray)
(18) *G. lamta* (Hamilton)
(19) *Labeo dero* (Hamilton)

Family : Cobitidae

(20) *Noemacheilus botia* (Hamilton)
(21) *N. rupecola* (McClelland)
(22) *N. beavani* Gunther
(23) *N. corica* (Hamilton)
(24) *Lepidocephalus guntea* (Hamilton)

Order : Siluriformes
Family : Amblycipitidae

(25) *Amblyceps mangois* (Hamilton)
Family : Bagridae

(26) *Mystus vittatus* (Bloch)
Family : Sisoridae

(27) *Bagarius bagarius* (Hamilton)
Order : Channiformes
Family : Channidae

(28) *Channa orientalis* Bloch and Schneider
Order : Mastacembelliformes
Family : Mastacembellidae

(29) *Mastacembellus armatus* (Lacé pède)

The species enumerated above are the first records from Corbett National Park.

Acknowledgements

The author feels grateful to Director, Zoological Survey of India, Calcutta, Officer-in-Charge, Northern Regional Station, Zoological Survey of India, Dehra Dun for facili-

ties and to Dr. Raj Tilak, Superintending Zoologist, Zoological Survey of India, Dehra Dun for checking the identification of the species and going through the manuscript.

References

Day, F. (1878). *Fishes of India.* London.

Hora, S.L. (1937). Notes on fishes in the Indian Museum. XXXIII. On a collection of fish from Kumaon Himalayas. *Rec. Indian Mus.*, 39(4): 338-341.

Menon, A.G.K. (1949). Fishes of Kumaon Himalayas. *J. Bombay nat. Hist. Soc.*, 48(3): 535-542.

Pant, M.C. (1970). Fish fauna of Kumaon hills. *Rec. zool. Surv. India*, 64 (1-4) : 85-96, 1966.

Raj, S.B. (1945). The decline of Mahseer fisheries of Kumaon lakes and possible remedy. *Proc. nat. Inst. Sci. India*, 11: 341-345.

Tilah, R. (1969). Descriptions of two new sisorids and a hybrid carp from Pauri Garhwal (Kumaon hills) Uttar Pradesh. *J. Inland Fish. Soc. India*, 1 : 37-48, figs. 1-14.

Walker, W. (1888). Angling in Kumaon lakes. Calcutta.

Children's Page

Christmas at "Cheetal Walk"

Ever since I was a child I have been spending my Christmas in the jungle. The time had come when we had to think of a suitable place to spend our 1975 Christmas. After considering various places we decided that we would spend it in 'Cheetal Walk' our jungle cottage in the Nilgiri foot hills 14 miles from Ooty.

We packed our provisions, not forgetting the X'mas cake and set out on Friday 19th December. On the way we cut a beautiful Christmas tree and placed it on the roof carrier of the car and went down the ghat road.

On arrival we heard that a big wild elephant was found dead a few miles from our place a week ago. The people around thought that it was the big friendly tusker which frequented our place. I felt very sad and the rest of the family consoled me and that they would take me to the Forest Ranger's office the next morning where we could see the tusks and make sure if it was the same elephant.

Soon after breakfast the following morning my father took me to the Ranger's office at Masinigudi, to see the tusks. After a long argument over the tusks we came to the conclusion that it was not "Bumpty's" (the name I had given our tusker because of the big bumps he had on his head) as Bumpty's tusks were slightly chipped at the tips. But still doubts remained in my mind.

Our cottage is at the edge of the jungle facing a small jungle river. And it is possible to see wild animals from our verandah as they come to the river to drink. We have also made two clearings in the jungle in front and animals crossing the clearings can be seen from the house.

That evening two big tuskers came and drank water in the river right in front of our house and one tusker looked similar to my friend "Bumpty". But a closer look told me that it was not him. Anyway it was a grand sight to see such huge animals so close to ones house. It gave me a great thrill.

In the next few days we started preparing for X'mas. We set up the Christmas tree and hung up decorations. Soon it was Christmas eve. That night we burst crackers and went to bed late. Some years ago during this time it was common to hear tigers. So we always slept with both ears open for tiger and other animal sounds.

X'mas morning dawned bright and clear and we got up early. We could not wait to have the X'mas cake with breakfast, so we ate most of it with bed coffee. At about

eleven O'clock we went to Church in Mavanhalla a small village two miles from our place. Later we distributed presents to the people around and to our servants. For lunch we had jungle fowl roast—a nice young cock Daddy had shot the previous day. That night we did not have to burst crackers. Elephants were breaking bamboos very close to the house and it sounded just like the bursting of crackers !

That night I stayed on the verandah for a long time hearing jungle noises. Before going to bed we sang carols, but softly so as not to disturb the elephants and other jungle animals around.

The next day my father and I went into the jungle to shoot jungle fowl. We were lucky to get one and were also lucky to escape from an elephant whom we had run into. Luckily it was not close enough to make a charge. In the evening we sat on one of the machans we had made on a bamboo clump by the river and took photographs of animals that came to the river. Each time a tusker came I would get excited hoping to see my friend Bumpty. But I was disappointed. My father spent most of his time watching, studying and photographing wild dogs at their dens which he had found; Mummy was the doctor for the people around. Priya was studying birds and Mark was our mechanic and driver. And it was my duty to look after our cattle, Sandy our Spaniel, our Siamese cat, fowls and pigeons.

On our land we have a lot of ber (*Zizyphus injuba*) trees. This was the fruiting season. The fruits attracted many animals including sambar, spotted deer, wild boar, porcupine and bear. Most of them visited these trees at night. Some like spotted deer and langur and occasionally wild boar came even during the day. We observed a strict rule not to shoot or disturb them. And they were not afraid of us and would wander around our property within sight of the house. I do not think this happens anywhere else in India. It is like living in a zoo with all the animals let loose. That is why we love to spend our time at 'Cheetal Walk'.

New Year was coming up fast. On New Year's eve only my sister Priya was in the house. My mother and Mark were away shopping in Masinigudi and my father and I were out trying to shoot a jungle fowl (the area being open to shooting with game licence). When we returned to the house Priya gave us the happy news that Bumpty was back. She said that he was with another small tusker and had crossed our land. I could hardly believe it. They were still there near the river. I could hear them breaking bamboo and feeding on it. As Bumpty was among some large bamboo clumps I could not see him. But he had a way of breaking bamboo. The tusker in the clump was breaking bamboo the same way Bumpty did. I questioned my sister closely about his description—his ears—(his left ear was torn), his tail (he had a stump tail), the bump on his head etc.

Her answers confirmed that it was Bumpty. I was happy he, was alive and well. But before I could actually see him night came.

I sat up in the hope of seeing him. But it was a dark night and although he was feeding close to the house I could not see him. Around midnight I thought I heard him trumpet. It was his way of wishing us a happy New Year ! I wished him back. By morning he had moved on. I hope he will come back soon to make my New Year happy.

Peter Davidar

"Canowie",
Coonoor 643 101,
Nilgiris.

On an Abnormality in Some Dorsal Vertebrate of Indian Wild Elephant (*Elephas maximus* Linnaeus)

While making faunal observations in the Corbett National Park in November, 1972, the author came across the skeletons of two wild elephants, which according to Park authorities, were accidently electrocuted a few months back. The bones were found at two places within a distance of about 15 Metres and were strewn around. Some bones were missing but partially damaged skulls and some bones were still there. A few dorsal vertebrae caught the author's attention as their neural spines were prominently bent to left side. On careful examination in the laboratory, later on, these abnormal vertebrae did not bear scars confirming any fresh injury to the deceased animal. The postzygopophysis of the left side was much bigger in size and somewhat irregularly developed. There was more calcification on that side in comparison to the right side of the bent neural spine.

It is rather difficult to explain the deformity, perhaps it was due to some physical injury at a very young age. However, the chances of a possible prenatal deformity can also not be ruled out.

Northern Regional Station,
Zoological Survey of India,
Dehra Dun-248001.

J.C. Tripathi

At what age does the male Indian elephant starts growing tusks

While doing bird counts on elephant back in Corbett National Park in March this year, self and party suddenly came upon a herd of about 30 wild elephants standing in thick foliage at Dhikala near the 'Bada Sal'. The herd consisted of 5 full grown tuskers, 16 females of various sizes and ages and 8 or 9 calves. One of the calves attracted my attention in particular. He was about 4½ feet tall as estimated later by the high of the termite mound around which he was playfully wrapping his trunk. The cause of attraction were a pair of bright thin tusks about 6-8 inches long. I tried to capture the scene with my chest-level focussing Exacta. The chest level focussing is not very quick and takes a little time. While I was still adjusting the calf in the view finder frame, a huge tusker, presumably the leader, materialised from a nearby thicket and advanced towards our mount threateningly. The Mahawat, Bashir, sensing the danger goaded Malan Kali (our mount) into motion before I could click. The tusker moved forwards and blocked Malan Kali's route standing sideways at about 15 feet and watching through baleful eyes. Bashir changed the route quickly only to find the tusker moving in an arc to block the exit again but keeping his distance. Bashir responded to the grave situation by first shouting loudly at the tusker (in which act we all joined him) and then hurling hurriedly broken pieces of thick branches at the tusker along with choisest abuses in chaste Urdu. The tusker in apparent disgust at the whole proceedings turned right about and walked away only to watch us beating a hasly retreat.

The dejection of missing a good photograph soon changed into relief of having escaped an ugly situation. I was very keen to photograph the calf with tusks because as far as known to me it is not mentioned any whese In the existing literature as to when a male Indian elephant starts growing the tusks. This calf was about 4½ feet tall. Judging from the fact that a new born calf is about 2½ feet tall this calf must be about 2 years of age and already had 6-8 inches long tusks.

Will some forest official or Zoo official having experience of birth of calves to female elephants under his charge kindly enlighten us further ?

Dr. B.S. Lamba
Northern Regional Station
Zoological Survey of India
Dehra Dun.
Jain/9.4.

———

Crocodile Rehabilitation Scheme in Uttar Pradesh

By

V.B. Singh

Chief Wildlife Warden

Not very long ago several rivers in U.P. had carried a good number of gharial population. Creation of reservoirs in the upper reaches and consequent drying up of the river down below, diversion of water through canals, construction of barrages coupled with indiscriminate poaching are some of the important causes leading to its depletion in course of a short period of about ten or fifteen years. Immediate efforts are needed to rehabilitate suitable waters with hand reared gharials.

The U.P. Forest Department under its own initiative started a study on the crocodile population in U.P. and three main rivers in North-West U.P. namely Ganga, Sarda and Ghagra were selected for this purpose.

A single clutch of 36 gharial eggs were collected during the month of April 1975 from west bank of Girwa river in Katerniaghat Range of Bahraich Forest Division. On 24th of April these were transported to Lucknow for artificial incubation and rearing. Incubation was carried out in a wooden case. Cracking was first noticed on 74th day i.e. on 5th July 1975 and by 6th July, 12 babies had fully hatched and by 15th July 21 babies were hatched. A day old hatchling was 34 cm long and 75 gm in weight. Out of 21 babies hatched one died on 24th July 1975.

On our request the centre was visited by Dr. H.R. Bustard, FAO expert. The efforts made by the wildlife organisation was greatly appreciated by him. His visit gave the state the opportunity to discuss the problem of gharial rehabilitation in its entirely. The scheme was worked out consultation with Dr. H.R. Bustard.

The main objectives of the scheme are as given under:—

(i) Detailed survey of existing crocodile population in the State

(ii) Based on above survey to collect the isolated population, to protect the viable population and to locate nesting sites.

(iii) Establishment of breeding centre.

(iv) Essential research on ecology of crocodile which will provide basic essential data about its habits, growth and habitat.

Out of the 20 babies hatched 10 babies were transported to Tikerpara Crocodile Project, Orissa during August 1975. Remaining 10 babies have been kept in a small rearing pond constructed at Kukrail during month of May 1975. The pond is provided arrangement for water supply. The entire pond has been covered with wire nesh for with protection purposes.

The babies are kept under strict watch and regular periodic measurement of size and weight of the babies are made and a record is being maintained. The maximum length of the babies is about 70 cms and weight is about 360 gm.

Counted fishes reared in a small pond are given to these babies and an account of fishes consumed by the babies is maintained. There is arrangement for changing water of the pond.

With the onset of winter difficulty was experienced in keping the water temperature high which fell to about 14°C. To overcome this difficulty the entire enclosure was covered with the help of wooden frames with polythene sheets and thatched grasses. Two water heaters have been fitted by haging them close to the tank. The heater is operated for about 8 to 10 hours daily. With all such arrangements we have been able to maintain temperature at about 20°C which is quite suitable for them.

Another big rearing pond is being constructed in this area where the babies will be reared for about 3 years, when they will be big enough to fend for themselves and survive in nature.

Katernighat in Baharaich district close to Girwa river has been selected as a centre for rehabilitation of gharial where hand reared gharials can be released. Construction work of rearing pond and a laboratory has been started in that area. The survey work of existing crocodile population has also been started.

An amount of Rs. 3.77 lakhs have been sanctioned for meeting the non-recurring expenditure of this project for which the recurring expenditure will be met by the State Government. The total recurring expenditure on staff and maintenance is Rs. 1.00 lakh. Out of the total amount sanctioned by Government of India Rs. 2.00 lakhs are to be spent during 1975-76

The execution of the project will restore the crocodile population in the State and future of gharial in the State will be assured It will in fact usher in many more projects for the preservation and rehabilitation of several other vanishing species of wildlife.

———

NOTES

A large number of fish died in Ramganga river as a result of severe hailstorm.

———

I visited Corbett National Park in the month of March 1976 in connection with a MAB Project to be undertaken in the area. On my way I stopped at Ramnagar to call on the Field Director, Tiger Project, Corbett Reserve, Shri C.B. Singh. During our discussion on the Park's Wildlife in general Shri Singh mentioned about large number of fish, mostly *Gonch* and *Mahseer* (some of them as big as 4½ feet) found dead in Ramgana after a severe hailstorm in February. He asked me for a possible explanation for the happening. Needless to say that I was stumped by the question. The only two possible reasons which came to my mind at that time and which I offered to Shri C.B. Singh with due reservations, were:—

(i) A hail storm of exceptionally severe intensity could possibly cause pressure waves in water, especially shallow stretches, strong enough to rupture the air sacks. This is known to happen when explosives are used under water, killing the fish within the effective range.

(ii) *OR* some of the curious and playful ones among the fish population may have swallowed a few of the hailstones. It is a well known fact that the fish never drink (contrary to the idiom "to drink like fish"). So a large doze of water inside the fish's stomach could possibly cause death.

After placidly listening to my explanations Mr. Singh commented that it was the belief of the local people that the fish eat the hailstones and die of cold. Fish being cold blooded animals are adapted to changes in water temperatures. They are unlikely to die of reduction of water temperature even if it is rather sudden. Which, of course, I brought to his notice.

Later while taking bird walks along the Ramganga I came accross plenty of evidence, by way of dried up and bare skeletons of a large scale mortality in fish. Some of the skeletons especially of *Gonch* were more than a metre in length.

Will some icthiologist or a fishing enthusiast naturalist amongst the readers, kindl y throw more light on this phenomenon.

Dr. B.S. Lamba

Northern Regional Station
Zoological Survey of India
Dehra Dun.
Jain/8.4.

———

A tree is known by the fruits it bears;

A forest is known by the animals it rears.

Come and see it for yourself

Visit:

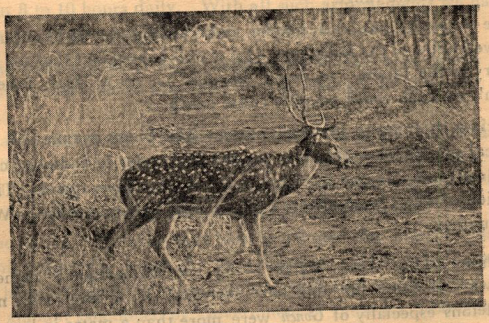
PALAMAU NATIONAL PARK

&

HAZARIBAGH NATIONAL PARK

IN

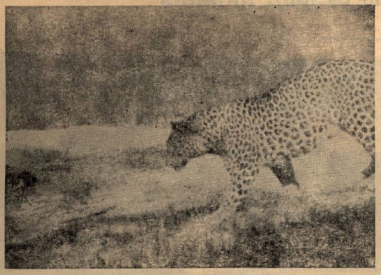
BIHAR



For details please contact:—

1. **Divisional Forest Officer,**
   Daltonganj South Division,
   At & P.O. Daltonganj,
   Dist. Palamau (Bihar).

2. **Divisional Forest Officer,**
   Hazaribagh West Division,
   At & P.O. Hazaribagh,
   (Bihar).



Uttar Pradesh's

Twin Attractions

FOR LOVERS OF WILDLIFE

CORBETT NATIONAL PARK

DUDWA NATIONAL PARK

Corbett National Park is famous all over the world for its scenic grandure and its wildlife—elephant, tiger, deer (several species) and a host of other mammals, birds and reptiles—the Ghariyal and snubnosed crocodiles and the might "Mahasheer" fish.

DUDWA Sanctuary now National Park famous for its only surviving herd of 2000 Swamp deer, Tiger, Spotted deer, Sambhar, Hog deer, Barking deer, Sloth bear, Wild boar, Marsh crocodile and hundreds of colourful birds. It is a paradise for bird watchers. *Conducted tours arranged.*

All Amenities provided.

Write to :—

CONSERVATOR OF FORESTS

Wildlife Preservation Organisation

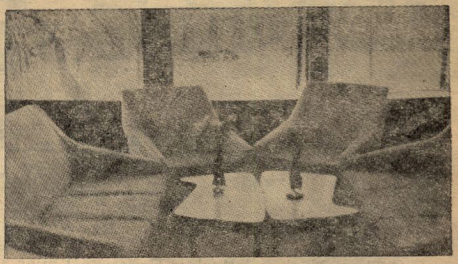
17, Rana Pratap Marg,

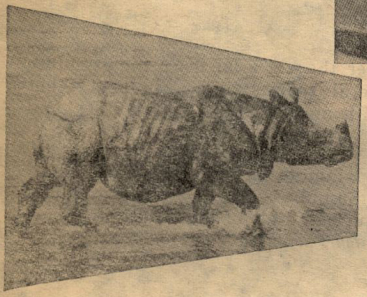
LUCKNOW

Tel: Wildlife :: *Phone*: 26140

Have a drawing-room view of wild animals

VISIT





JALDAPARA WILD LIFE Sanctuary

*Home of One-horned rhinoceros.

*Gaur, elephants, tigers.

*Varieties of deer and other animals.

*Furnished Tourist Lodges with full catering arrangement.

*Approachable by Road, Train and Air.

*Jeep available.

Please contact :—

DIVISIONAL FOREST OFFICER
COOCH BEHAR
(Phone C.B. 247)
WEST BENGAL

OR

FOREST UTILISATION OFFICER
8, Lyons Range, CALCUTTA
(Phone 22-2774)
WEST BENGAL

DEHRA DUN

Patran in Chief :— H.E. Shri Fakhruddin Ali Ahmed

President:— Col. Pratap Singh Malvendra of Nabha

Executive Vice-President:—Shri T.S. Negi. I.P. (Retd.)

Hony. Secretary & Treasurer:—Dr. R.N. Misra

Hony. Asstt. Secretaries:—

. Dr. S.K. Sangal.
2. Shri S.K. Sinha.
3. Shri N.K. Gaur.

Delhi Branch

President:—Shri Pratap Keshari Singh Deo of Kalahandi

Exe. Vice President—Col. Sher Jung, A-2/4 Model Town, Delhi

Hony. Secretary:—Commander K.N. Bahl

Assam Branch (Shillong)

President:—Maharaja of Charkhari

Hony. Secretry:—Mr. M.A. Islam, I.F.S.

Bihar Branch (Monghyr)

President:—Kumar Surindra Singh.

Hony. Secretary:—Prof. A.A. Khan.

Editorial Board

. Dr. R.N. Misra. 2. Shri R.D. Singh. 3. Dr. S.K. Sangal. 4. Shri K.C. Sahni. 5. Shri N.K. Jain.

Buy from the Hony. Secretary, Wildlife Preservation Society of India 7, Astley Hall, Dehra Dun.

		Price
()	Society's Tie (with Cheetal head in gold on green silk)	... 20.00 each
(2)	Balance of Nature Game (for Members)	... 9.00 „
(3)	'National Parks' by K.S. Sankhala, I.F.S. (Published by W.L.P.S.I.) (Post free)	... 9.00 „
(4)	Singh Parivar in Hindi by M.D. Chaturvedi	... 3.00 „
(5)	Panther on the Prowl by M.D. Chaturvedi	... 3.25 „
(6)	CHEETAL—I.U.C.N. Special Souvenir Issue, 1969	... 7.00 „
(7)	„ „ „ „ „ 1972	... 5.00 „

Edited by Dr. R.N. Misra, Dr. S.K. Sangal and Shri R.D. Singh and Published by Dr. R.N. Misra (Hony. Secretarey for the Wildlife Preservation Society of India, 7, Astley Hall, Dehra Dun and Printed by T.C. Sharma at Dun Printing House, Rajpur Road, Dehra Dun.

Wild Life Preservation Society of India

1. The aims and objects of the Society are as follows:—

   (a) To promote interest in and impart knowledge regarding the preservation and conservation of all forms of wild life, particularly among the youth of the country.

   (b) To co-operate with the Govts. of India and States and with other Societies and Institutions having similar aims and objects in working for the interests of wild life.

   (c) To assist in enforcing and actively supporting the Forest Acts, Wild Birds and Animals Protection Acts and Rules etc. of States and the Indian Arms Act and Rules in so far as they pertain to wild life and to bring to the notice of the authorities any infringement of the same and to assist in the detection and prosecution of offenders in respect of such laws.

   (d) To advise and help the Govt. and wild life administrators in the formation, maintenance and protection of Sanctuaries and National arks, the preservation of wild life in general and rare species of India in particular and in the introduction of exotic species into the country, the rehabilitation of rare species etc. and in the revision on rational lines of the shooting and fishing rules, so as to conserve and increase wild life stocks.

   (e) To raise funds for the carrying out of the above aims and objects and to found and maintain museums, reading rooms and libraries of natural history in order to disseminate knowledge regarding wild life.

   (f) To promote sportsmanship in shikar and to recognise well regulated shooting and fishing, as a means of preserving wild life and fish so that through wise use the surplus may provide a recreational asset to the nation.

   (g) To carry out publicity and propaganda for the preservation of wild life in India by means of monographs, journals, films, film strips and other feasible methods.

   (h) To assist members of the Society in obtaining shooting and fishing facilities and facilities for viewing and photographing wild life in India.

   (i) To conduct research into the problem of Wild Life management in India, and in pursuance of this, to initiate, encourage and, where possible assist in projects for the study of threatened speceis and related subjects and to provide reference and research facilities for such work.

   (j) To carry on such other activities which will serve the above subjects.

What membership of Wild Life Preservation Society of India will entitle you to ?

1. You will become an active member of the growing group of Wild Life enthusiasts, who enjoy working for and spreading the knowledge of how to conserve India's heritage of Wild Life for posterity.
2. You will be entitled to the full use of the Library of the Wild Life reservation Society and of its reading room.
3. You will receive a membership certificate.
4. You will receive personal Identification and Membership card.
5. You will be entitled to buy all publications of the Society at a concessional rate.
6. You will be entitled to buy at concessional rates the Society's Greeting Cards, Calendars, Tie, Lapel badge and the Balance of Nature Game (specially ublished in colour for its educative and recreatcnal value).
7. You will be supplied "Cheetal", the quarterly journal of the Society free.

For membership particulars write to Honorary Secretary, Wild Life Preservation Society of India, 7 Astley H

Date of Publica